REPORT RESUMES

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A GUIDE TO THE FURTHER DEVELOPMENT OF INDUSTRIAL EDUCATION CENTERS IN NORTH CAROLINA, A REPORT OF A STUDY OF THE NORTH CAROLINA INDUSTRIAL EDUCATION CENTERS.

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NORTH CAROLINA STATE BOARD OF EDUCATION, RALEIGH

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A STATEWIDE SYSTEM FOR POST-HIGH SCHOOL PREEMPLOYMENT AND EXTENSION TRAINING IN TECHNICAL AND VOCATIONAL EDUCATION IN THE FORM OF INDUSTRIAL EDUCATION CENTERS WAS BEGUN IN 1958. THIS GUIDE INCLUDES A STATUS REPORT ON THE CENTERS, AN EXAMINATION OF THE EDUCATIONAL NEEDS THEY SHOULD MEET, AND RECOMMENDATIONS FOR THEIR FURTHER DEVELOPMENT AND IMPROVEMENT. FOUR TYPES OF PROGRAMS ARE BEING OFFERED -- TRADE AND TECHNOLOGY, MACHINE OPERATOR TRAINING, SUPERVISORY TRAINING, AND UPDATING FOR EMPLOYED ADULTS. FULL-TIME, EXTENSION, AND PART-TIME CURRICULUMS ARE OFFERED FOR TECHNICIANS, SKILLED CRAFTSMEN, TECHNICAL SPECIALISTS, AND SKILLED SPECIALISTS. INCREASED MANPOWER NEEDS SERVED AS A MAJOR BASIS FOR THE ESTABLISHMENT OF PROGRAMS FOR THE 20 CENTERS. PROGRAM ALLOCATIONS WERE BASED ON -- (1) THE GEOGRAPHICAL SPREAD OF EMPLOYMENT OPPORTUNITIES, (2) ESTABLISHED OR PLANNED PROGRAMS IN EXISTING CENTERS, (3) STUDENT POTENTIAL, AND (4) HOUSING ACCOMMODATIONS FOR STUDENTS. RECOMMENDATIONS INCLUDE -- (1) CONCENTRATION ON ADULT AND POST-HIGH SCHOOL LEVEL, (2) EXPANSION OF PROGRAMS INTO NEW FIELDS, (3) ESTABLISHMENT OF STATE-WIDE COMPETENCY EXAMINATIONS, (4) INITIATION OF STUDENT RECRUITMENT PROGRAMS, AND (5) ACCREDITATION OF CURRICULUMS. EMPLOYMENT DATA FROM THE MANPOWER STUDY ARE INCLUDED. (EM)

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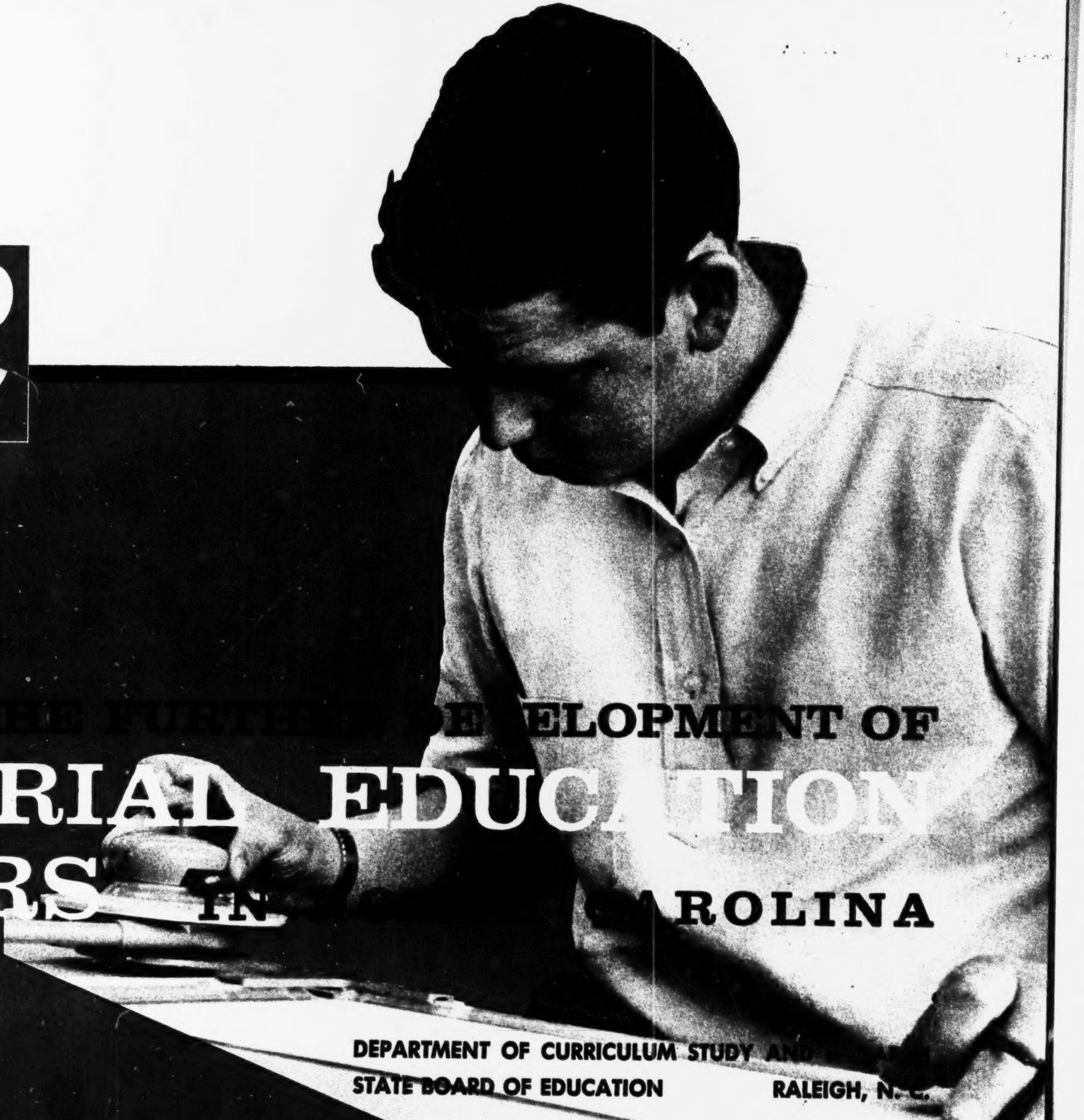

A GUIDE TO THE FURTHER DEVELOPMENT OF
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CENTERS IN NORTH CAROLINA

VT000537

1963

DEPARTMENT OF CURRICULUM STUDY AND RESEARCH
STATE BOARD OF EDUCATION RALEIGH, N. C.

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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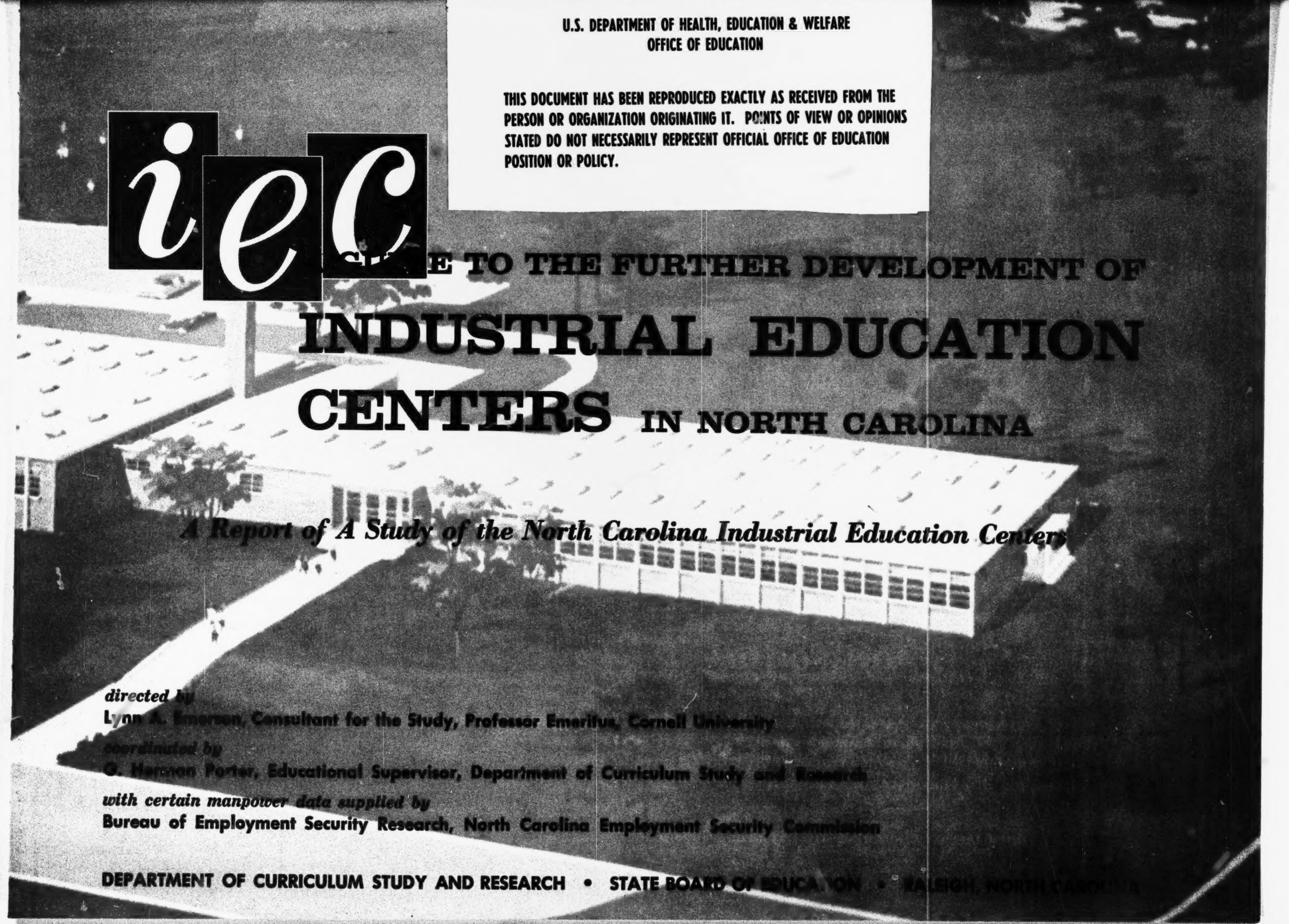

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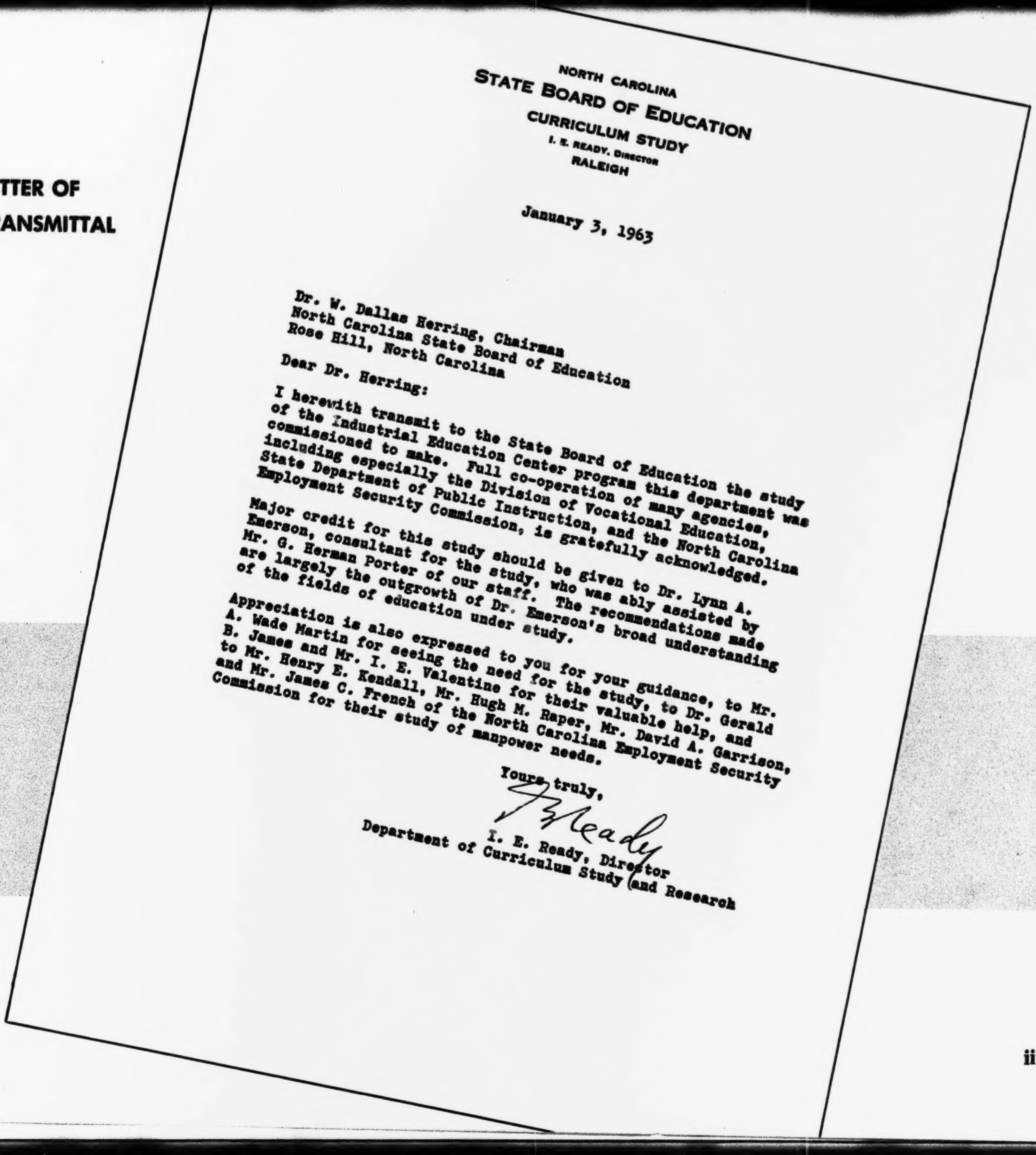
GUIDE TO THE FURTHER DEVELOPMENT OF INDUSTRIAL EDUCATION CENTERS IN NORTH CAROLINA

A Report of A Study of the North Carolina Industrial Education Centers

directed by
Lynn A. Emerson, Consultant for the Study, Professor Emeritus, Cornell University
coordinated by
G. Herman Porter, Educational Supervisor, Department of Curriculum Study and Research
with certain manpower data supplied by
Bureau of Employment Security Research, North Carolina Employment Security Commission

DEPARTMENT OF CURRICULUM STUDY AND RESEARCH • STATE BOARD OF EDUCATION • RALEIGH, NORTH CAROLINA

LETTER OF TRANSMITTAL



NORTH CAROLINA
STATE BOARD OF EDUCATION
CURRICULUM STUDY
I. E. READY, DIRECTOR
RALEIGH

January 3, 1963

Dr. W. Dallas Herring, Chairman
North Carolina State Board of Education
Rose Hill, North Carolina

Dear Dr. Herring:

I herewith transmit to the State Board of Education the study of the Industrial Education Center program this department was commissioned to make. Full co-operation of many agencies, including especially the Division of Vocational Education, State Department of Public Instruction, and the North Carolina Employment Security Commission, is gratefully acknowledged.

Major credit for this study should be given to Dr. Lynn A. Emerson, consultant for the study, who was ably assisted by Mr. G. Herman Porter of our staff. The recommendations made are largely the outgrowth of Dr. Emerson's broad understanding of the fields of education under study.

Appreciation is also expressed to you for your guidance, to Mr. A. Wade Martin for seeing the need for the study, to Dr. Gerald B. James and Mr. I. E. Valentine for their valuable help, and to Mr. Henry E. Kendall, Mr. Hugh M. Raper, Mr. David A. Garrison, and Mr. James C. French of the North Carolina Employment Security Commission for their study of manpower needs.

Yours truly,

I E Ready

I. E. Ready, Director
Department of Curriculum Study and Research

FOREWORD

This guide includes a status report on the North Carolina Industrial Education Centers, an examination of the educational needs they should meet, and recommendations for their further development and improvement.

In the summer of 1960, the North Carolina State Board of Education directed the Department of Curriculum Study and Research to conduct a study of the manpower and educational needs in technician and skilled crafts occupations and of the effectiveness of the Industrial Education Centers in meeting these needs. Mr. A. Wade Martin, then supervisor of Trade and Industrial Education, had recommended that such a study be undertaken.

The need for a manpower study to develop information needed was explored with the North Carolina Employment Security Commission. Out of an awareness of this need, the Commission became interested in the study and subsequently, when a grant was made by the United States Department of Labor, the Commission's Bureau of Employment Security Research immediately began planning a manpower study, which study is used in this report.

In June, 1960, Dr. Lynn A. Emerson, professor emeritus of Cornell University and well-known authority in technician and trade education, was employed on a part-time basis by the Department of Curriculum Study and Research to serve as consultant. He provided assistance to the Employment Security Commission in planning the Manpower Study, especially in determining the items needed in the schedules in order to obtain information needed for educational planning. He has given direction to all studies conducted by the Department of Curriculum Study and Research relative to Industrial Education Centers, culminating in this report.

In July, 1960, a conference was held to discuss the kind of survey needed for the Manpower Study and to explore possible methods of financing. Representatives from the following agencies were represented: North Carolina Employment Security Commission, Bureau of Employment Security of U. S. Department of Labor, Division of Vocational Education of the State Department of Public Instruction, and the Department of Curriculum Study and Research of the State Board of Education.

In planning the survey, the Employment Security Commission conferred several times with various representatives of the agencies listed above to plan survey methods, to determine occupations to be surveyed, and to plan the items to be included in the survey schedules. Such co-operative efforts helped to make the survey of maximum benefit for planning education for Industrial Education Centers.

In March, 1961, the Employment Security Commission provided a week of training for their seven labor market analysts who conducted the interviews. The field work for the survey was then completed in about nine months.

In January, 1962, after data were edited, machine processed, and summarized, a preliminary report of outcomes of the survey findings was prepared and presented to the Department of Curriculum Study and Research. These findings were used for preliminary educational planning until the final report of the total Manpower Study was completed by the Commission.

During 1961 and early 1962, various data were gathered by the Curriculum Study staff. Visits were made to most of the Centers to gain an understanding of the general status of facilities, equipment, programs offered and projected, and current enrollments. Technician and trade programs in other states were studied through available studies and catalogues and through visits. Data on some manpower needs which could not be covered in the Manpower Study were gathered. A status study of education beyond the high school of less than four-year degree length was made. Data on major industries were summarized and plotted on maps according to concentrations. Student potential was computed by counties, using census of population data and the findings of a high school graduate follow-up study.

Various aspects of these collected data are presented in this report, including selected data from the report of the Manpower Study.* They were the bases for developing the policies, and recommendations, and making the program allocations included in this report.

---

* Employment Security Commission of North Carolina, Bureau of Employment Security Research, *North Carolina Study of Skilled and Technical Manpower*, Raleigh, 1962.

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CHAPTER I

BACKGROUND OF THE INDUSTRIAL EDUCATION CENTERS

A state-wide system known as Industrial Education Centers was begun by the North Carolina State Board of Education in 1958. Many elements contributed to the need for and later development of these Centers. Of special significance was the prevailing lack of educational opportunity for technical and trade education to meet the demands for education by the people and the manpower needs of an expanding industry.

The leadership of three individuals was especially outstanding in conceiving the idea of the Centers and in their initial development. They were the following: The Honorable Luther H. Hodges, Governor of North Carolina (1954-1960); Dr. W. Dallas Herring, Chairman of the State Board of Education (1957 to the present); and A. Wade Martin, State Supervisor of Trade and Industrial Education (1957-1961).

INDUSTRIAL EDUCATION PRIOR TO THE DEVELOPMENT OF THE CENTERS

A big void in educational opportunity which became obvious and which stimulated the development of the Centers most was in technical and industrial education beyond the high school. It was recognized that North Carolina's potential industrial growth was limited by the lack of educational programs for training technicians, skilled craftsmen, and skilled specialists. In addition to the industrial field, other educational needs to be met through the Centers are now becoming more generally recognized in such fields as agriculture, business, service, and home economics.

Industrial education provided through the public schools prior to 1958 was that provided in a limited number of the public high schools, which were mostly in large urban centers. This type of training is known as trade and industrial education.

Staff and facilities were not sufficient to provide adequate trade and industrial education, especially to those beyond the high school. Very little technician level education was provided.

Shown below is the enrollment* in the various types of trade and industrial education programs during the 1957-1958 school year.

Type Program	Enrollment
Day trade	4,810
Cooperative	1,198
Apprentices	603
Evening Extension	6,314
	12,925

Some additional industrial education outside the high school was provided by the North Carolina Vocational Textile School which enrolled approximately 200 students. Most of these were students beyond the high school. Also, approximately 150 high school graduates were enrolled in Gaston Technical Institute which provided curriculums for training technicians (engineering aides).

CIRCUMSTANCES SURROUNDING THE EARLY DEVELOPMENT OF THE INDUSTRIAL EDUCATION CENTERS

During recent years, increased emphasis has been given by appropriate State and local agencies to the industrial development of North Carolina. Out of this new emphasis on industrial development came the idea of developing a system of education which would contribute significantly to the development of North Carolina's abundance of human resources.

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*Taken from: *Digest of Annual Reports of State Boards for Vocational Education—1958*, U. S. Dept. of Health, Education and Welfare, Washington, 1959.

The general recognition of two factors contributed greatly to the development of the Centers. First, North Carolina needed a better trained manpower supply and in greater numbers for the existing industries as well as for potentially new and expanding industries. Second, it should be the right of every individual to have educational opportunity to develop according to his potential. Furthermore, it was recognized that technological advances in industry, business, and agriculture which are interwoven with changing concepts of living standards and social life have created a special need for extending education beyond the high school to a greater number of citizens.

The Centers developed rapidly. This development was hastened as a result of the availability of funds at the federal, State, and local levels and dynamic leadership at the State and local levels in making studies of need and in initiating program planning.

Once the industrial education needs were recognized, challenge funds which were made available by the 1957 General Assembly were approved by the Advisory Budget Commission and allocated to the State Board of Education for initiating a statewide system of Industrial Education Centers. During 1957 and 1958, studies were made relative to needs for programs of industrial education throughout the State. Most of these studies were conducted by people in local communities who recognized the contribution an educational institution such as an Industrial Education Center would make to the welfare of the community and the people of the area. Once a Center was approved for an area, the people were responsive in providing funds for constructing the building. It was understood then, as is still the policy, that the local communities would provide an approved site and building, and most of the other expenses would be provided through State and federal appropriations.

The availability of equipment through the Federal Surplus Property Agency and the passage of Title VIII of the National Defense Education Act of 1958 contributed greatly to the development of the Centers. Title VIII of the Act provided funds and authorization for area vocational educational programs for the training of highly skilled technicians in recognized occupations requiring scientific knowledge essential in fields necessary for the national defense. The provisions in this Act gave new impetus to the development of programs in the Centers to train technicians.

It was in 1959 that the General Assembly officially authorized a vocational school known and designated as an "Industrial Education Center," conducted for adults as well as mature or select high school students. During this same session of the General Assembly, funds requested by the State Board of Education were allocated for the operation of existing and proposed programs in the Centers.

PRESENT STATUS OF THE CENTERS

The State level administration of the Centers, as is true of other types of public schools, is vested in the State Board of Education. The State Board has established a number of policies and regulations for the establishment and operation of Industrial Education Centers. These policies were recently codified and are shown in Appendix A.

Number and Location of Centers

The State Board of Education has approved 20 requests for Industrial Education Centers. These Centers have been located strategically throughout the State and in such numbers as are economically feasible. Figure 1 shows the location of the Centers.

Provision has been made for the establishment of "units" of Centers when the need is justifiable. A "unit" is a satellite program conducted from an area Industrial Education Center.

Current policy of the State Board of Education regarding "units" states that where there is a need, a single course or curriculum may be established as a "unit" (or subdivision) of the area Industrial Education Center, provided adequate supervision can be given from the "parent" Center. Three criteria are listed:

1. Qualified students from an area rather than a single secondary school.
2. Local building facilities which meet the standards established.
3. Ability of the parent Center to schedule the instruction and furnish the necessary equipment.

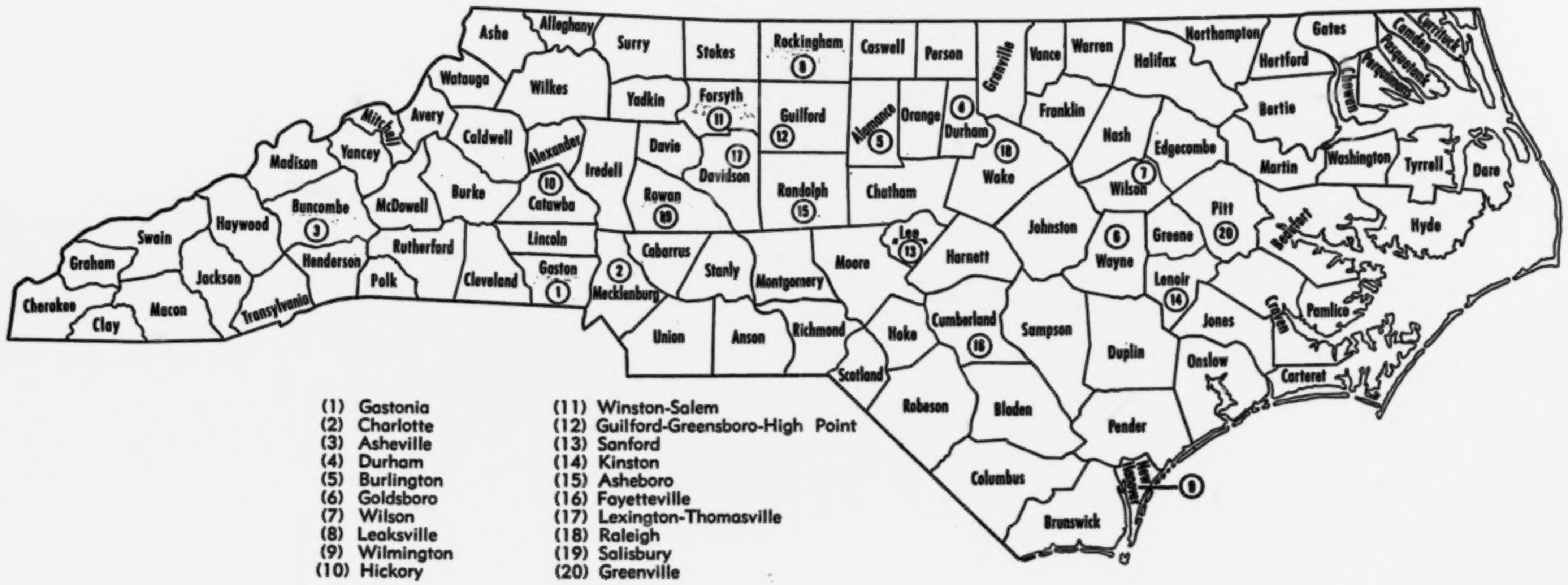
(1) Gastonia
(2) Charlotte
(3) Asheville
(4) Durham
(5) Burlington
(6) Goldsboro
(7) Wilson
(8) Leaksville
(9) Wilmington
(10) Hickory
(11) Winston-Salem
(12) Guilford-Greensboro-High Point
(13) Sanford
(14) Kinston
(15) Asheboro
(16) Fayetteville
(17) Lexington-Thomasville
(18) Raleigh
(19) Salisbury
(20) Greenville
Cherokee
Graham
Clay
Swain
Macon
Jackson
Haywood
Transylvania
Madison
Buncombe
Henderson
Yancey
Mitchell
McDowell
Polk
Rutherford
Avery
Watauga
Caldwell
Burke
Cleveland
Ashe
Alleghany
Wilkes
Alexander
Catawba
Lincoln
Gaston
Iredell
Mecklenburg
Surry
Yadkin
Davie
Rowan
Cabarrus
Union
Stokes
Forsyth
Davidson
Stanly
Anson
Montgomery
Richmond
Rockingham
Guilford
Randolph
Moore
Scotland
Caswell
Alamance
Chatham
Lee
Hoke
Robeson
Person
Orange
Durham
Harnett
Cumberland
Bladen
Columbus
Granville
Wake
Johnston
Sampson
Brunswick
Vance
Franklin
Warren
Nash
Wilson
Wayne
Duplin
Pender
New Hanover
Halifax
Edgecombe
Greene
Lenoir
Jones
Onslow
Northampton
Hertford
Bertie
Pitt
Martin
Beaufort
Craven
Pamlico
Carteret
Gates
Chowan
Perquimans
Pasquotank
Camden
Currituck
Washington
Tyrrell
Hyde
Dare

FIGURE 1. Location of Industrial Education Centers in North Carolina

State of Development—Plant and Equipment

At the time this report is made, all twenty of the Centers are operating at least on a limited basis. Fifteen Centers are operating in permanent facilities. The other five are in temporary facilities, operating on a limited basis, and awaiting the completion of new facilities.

Though a few Centers may be considered to be in full operation, all are still developing and growing in terms of facilities, enrollment, staff, and educational offerings. This lack of full development is caused by the fact that none of the Centers began operating more than three years ago.

Eighteen of the Centers are or will be housed in new plants. Several of the more established Centers have completed or are projecting additional buildings. Two of the Centers are chiefly housed in buildings previously used for other purposes. One is located in a large building, formerly used as a high school, which has been renovated and is very well adapted for Center education functions. The other Center is located in buildings which were formerly used as a hospital. Some renovation has been and is currently being made, but adequate adaptation has not been possible because of the large number of load-bearing walls throughout the buildings. An additional building has been built for some of the shops and laboratories and a new building is projected.

An inadequacy common to several Centers now in operation is the lack of classrooms. This limitation is expected to become more critical as the Centers become more fully developed.

In general, the Centers which have building facilities and programs in operation or projected are well equipped. Most of the equipment has been provided by the State Board of Education, using State and federal funds allocated for purchasing equipment, and equipment obtained through the Federal Surplus Property Agency and the National Industrial Equipment Reserve.

The current policy of the State Board of Education is that the State shall provide for the purchase, installation, and maintenance of equipment for the Centers. Title to equipment purchased from State funds remains with the State and may be transferred by the State Board of Education as needed. Suitable equipment now in possession of or available to the sponsoring school administrative units is made available for use in the Industrial Education Centers.

TABLE 1. Major Facilities Existing In Thirteen Currently Operating Industrial Education Centers, 1962.[a]

Facility	Centers													
	All Centers	Asheville	Catawba	Gastonia	Guilford	Leaksville	Winston-Salem	Charlotte	Burlington	Durham	Fayetteville	Goldsboro	Wilmington	Wilson
Air Conditioning Lab.	9		X	X	X			X	X	X	X		X	X
Auto Mechanic Shop	11	X	X	X	X	X	X	X	X	X	X	X		
Auto Body Shop	1							X						
Auto-Diesel Shop	2												X	X
Chemistry Lab.	6	X						X	X	X			X	X
Civil Tech. Lab.	2									X	X			
Cosmetology Shop	1			X										
Data Processing Lab.	1								X					
Diesel Shop	1						X							
Drafting Room	13	X	X	X	X	X	X	X	X	X	X	X	X	X
Electrical Lab.	4	X						X		X			X	
Electronics Lab.	13	X	X	X	X	X	X	X	X	X	X	X	X	X
Farm Machinery Shop	1											X		
Knitting Mach. Shop	3		X		X				X					
Loom Mach. Shop	2					X			X					
Machine Shop	11	X	X	X	X	X	X	X	X	X	X		X	
Physics Lab.	7	X		X				X	X	X			X	X
Print Shop	1						X							
Secretarial Lab.	1								X					
Sewing Mach. Shop	1													X
Upholstery Shop	2		X		X									
Welding Shop	6	X		X	X			X			X			X
Classrooms (Approx. No.)		7	4	4	10	2	5	30	10	5	2	3	6	2

[a] Data secured while visiting the Centers and conferring with the Center directors.

TABLE 2. Technology Curriculums Offered In Thirteen Industrial Education Centers, 1962.[a]

Technology Curriculum	All Centers	Asheville	Catawba	Gastonia	Guilford	Leaksville	Winston-Salem	Charlotte	Burlington	Durham	Fayetteville	Goldsboro	Wilmington	Wilson
Air Conditioning	5	X							X	X			X	X
Automotive	2								X	X				
Civil	2									X	X			
Commer. Art & Design	1								X					
Data Processing	1								X					
Dental Lab.	1									X				
Dental Assistant	1								X					
Electrical	1									X				
Electronics	12	X	X	X	X	X	X	X	X	X	X	X		X
Chemical	4	X						X	X	X				
Mech. Drafting	6					X	X		X	X	X			X
Mechanical	5	X						X	X	X				X
Tool Design	1								X					
Technical Drafting	3		X	X				X						
Arch. Drafting	1									X				
Tech. Secretary	1								X					
Transportation Main.	1													X
Textile	2					X			X					

[a] Taken chiefly from survey made in October 1961 by Trade and Industrial Education, Division of Vocational Education and supplemented from observations made while visiting Centers.

The major facilities existing in thirteen currently operating Centers are shown in Table 1. Though some of the shops and laboratories are in the process of being equipped, most are rather fully equipped.

Program Offerings—Nature and Scope

Tables 2 and 3 show the technology and trade curriculum offerings in thirteen Centers as of February, 1962. The technology curriculums are two years in length or the equivalent. Curriculums for the crafts vary from one to two years in length.

In addition to these, three additional types of programs are offered through the Centers. First, machine operator training is offered. Courses for this training are usually short and inten-

TABLE 3. Trade Curriculums Offered In Thirteen Industrial Education Centers, 1962.[a]

Trade Curriculum	All Centers	Asheville	Catawba	Gastonia	Guilford	Leaksville	Winston-Salem	Charlotte	Burlington	Durham	Fayetteville	Goldsboro	Wilmington	Wilson
Air Conditioning	6	X	X	X	X						X		X	
Auto. Body Repair	2							X		X				
Auto. Mechanics	10	X	X	X	X	X	X	X			X	X	X	
Inter. Combus. Engines	1												X	
Brick Masonry	5		X	X			X			X		X		
Carpentry	2									X		X		
Cosmetology	1			X										
Drafting	6	X	X		X			X		X		X		
Farm Machinery	1											X		
Printing	1						X							
Knitting Mach. Fixing	3		X		X				X					
Loom Fixing	1								X					
Machine Shop	9	X	X	X	X	X	X	X		X			X	
Practical Nursing	5	X					X	X		X		X		
Radio-TV Repair	4		X	X							X	X		
Sewing & Cutting	1		X											
Sheetmetal Work	1							X						
Tailoring	1									X				
Upholstery	2		X		X									
Welding	5	X		X	X			X			X			

[a] Taken chiefly from survey made in October 1961 by Trade and Industrial Education, Division of Vocational Education and supplemented from observations made while visiting Centers.

sive and are aimed toward developing skilled machine operators. Typical training programs include looper, drill press operator, punch press operator, and power sewing operator.

A second type of program offered in the Centers is supervisory training, aimed at upgrading supervisors and other responsible people employed in industry. Among the many types of courses offered are job relations, job instruction, time study, cost control, work methods improvement, and labor legislation.

A third type of program provided is updating classes for employed adults. A wide variety of courses are offered to adults for the development of skills and related information. Included among the many different updating courses are electrical code, heat treating, precision measurement, and color television servicing.

Enrollment

The enrollment in many of the Centers has been increasing rapidly, especially in extension and part-time courses. The big demand for employed adults for extension courses is indicative of urgent needs which have not been met. Though the extension program will continue to be an important function of the Centers, the development of full-time programs for future employees should be given greater emphasis. These will help to meet present and future technical and skilled manpower requirements.

The full-time day enrollment for none of the Centers has reached its potential. As the educational opportunities in the Centers become better known to potential students and to those who provide information and guidance to potential students, the full-time enrollment is expected to increase greatly.

The total enrollment during the year 1961-62 for the Centers was approximately 23,000. Much of this enrollment consisted of persons enrolled in extension courses. The number enrolled in technology curriculums, either part-time (15 hours per week) or full-time (30 hours per week) was approximately 6,500.

Potential student enrollment is discussed in Chapter VIII.

CHAPTER II

SOME BASIC POLICIES CONCERNING THE FURTHER DEVELOPMENT OF THE INDUSTRIAL EDUCATION CENTERS

The Industrial Education Centers of North Carolina have developed in response to rapidly changing needs of industry for skilled craftsmen and technicians, and in accordance with changing patterns of vocational education which are slowly but surely raising the age and grade level for such training to the post-high school years. Long term planning is needed to bring the Centers to their fullest effectiveness in providing opportunity for North Carolina youth and adults to get training suited to their interests, aptitudes and abilities, and to meet the needs of industry and business for trained manpower.

Training programs in the Centers have been developed to date largely on the basis of needs ascertained through local surveys, without the benefit of state-wide, detailed planning on a large scale. The present study attempts to bring together state-wide data on industrial needs, student potential, and present facilities, and to utilize these data for making recommendations for the further development of the Centers. In developing the long-term plans recommended in this study, certain basic policies concerning the establishment and operation of programs have been kept in mind. Among these basic policies are the following:

1. The ultimate *objective of the Centers* is to provide opportunity for all youth and adults in North Carolina who desire training for skilled and technical occupations to get such training, appropriate to their interests and abilities.

2. The primary *purpose of the Centers* is to provide training opportunity for high school graduates and other mature individuals who are capable of profiting from the instruction, through curriculums and courses which generally are beyond the high school in level of instruction. To the extent that facilities are available in the Centers beyond those needed for programs for high school graduates and adults, selected high school students from schools near the Centers are accommodated in programs suited to their abilities and needs.

3. The *over-all program* provides both pre-employment and extension training for the occupational fields of *highly skilled technicians, technical specialists, skilled craftsmen, and skilled specialists.** The range of programs provided will be such as will meet the needs of persons of different types and levels of ability who have aptitude for the occupational fields noted above.

   These occupational fields are found in most areas of the world of work. The over-all program of the Centers will include training for the various areas of the world of work such as *agriculture, business, health and other services, and industrial areas.*

4. *The program will be sufficiently flexible* to meet the needs of persons who desire full-time training, those who desire pre-employment training for a new field while still working at other types of jobs, and persons now employed who desire training for updating and upgrading. The schedule will provide classes at appropriate hours for shift workers. Schedules for pre-employment training programs for employed persons will permit attendance up to 15 hours per week, day or evening.

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* For information on the identification of technician and technical specialist occupations, and comparison of these occupations with the skilled crafts, see: Lynn A. Emerson. *Technician Training Beyond the High School*, Division of Vocational Education, State Department of Public Instruction, Raleigh, N. C., 1962. Chapter 2.

5. *Training opportunities for employed persons* are of great importance to the Centers. The total enrollment of such students may well be considerably greater than the number of full-time students.

6. *Curriculums for pre-employment training* for highly skilled technicians and for highly skilled craftsmen will generally provide for two years of full-time study. Pre-employment curriculums for technical specialists and skilled specialists will be shorter in length. Extension courses for employed workers will usually be of the unit type and of short length.

7. Curriculums for the *training of highly skilled technicians* will provide adequate, intensive coverage of the primary or central technology, supported by basic and related technology, and by appropriate mathematics, science and drawing. A reasonable amount of appropriate general education will be a part of each such curriculum.

8. Curriculums for the *training of highly skilled craftsmen* will provide adequate shop and laboratory work of appropriate types, supplemented by related instruction in the technology of the craft, and by basic and applied science, mathematics, and drawing, related to the craft. A reasonable amount of appropriate general education will be included in each curriculum.

9. Curriculums for the *training of technical specialists and skilled specialists* will consist primarily of instruction in the technical and manipulative skills pertinent to the occupation, supplemented by such closely related technology, science, mathematics, and drawing, as is appropriate.

10. Effort will be made to insure that all *programs will be operated at a high level of quality.* This will entail well-developed curriculums, well-prepared courses of study, good instructional materials, adequate laboratory and classroom equipment, well-prepared instructors, and carefully selected students.

11. *When technician and skilled crafts training programs are offered in the same Center,* the objectives of each type of program will be kept clearly in mind, and effectiveness will not be decreased by improper mixing of classes or by other procedures that tend to destroy the entity of either type of program.

12. *Economical operation of the program of a Center* will be safeguarded in so far as is possible by having a first-year enrollment in each full-time program of approximately 20 students, with an expected retention of 12 students for the second year, in programs of minimum size. In Centers with programs of larger than minimum size, such as those which require especially costly equipment which should be used to maximum capacity, the enrollments will be proportionately larger.

13. In the over-all planning of a Center, the *plant and equipment needs* will be projected on the basis of the full-time pre-employment curriculums for the training of technicians and skilled craftsmen, and the programs for training technical specialists and skilled specialists which require special equipment. It is assumed that part-time offerings can be handled without additional space and equipment.

14. The total program of a Center will be developed in the light of *inter-relationships between curriculums* with respect to common instructional content and utilization of equipment. Skilled crafts programs will usually be offered in the same Centers which offer technician training in the same occupational fields.

15. The *location of new Centers* will take into consideration the proximity of industrial establishments with workers who desire extension training, and the distances students will have to travel to attend day or evening classes.

16. *Satellite programs* of small scope conducted from certain Centers will be established only after careful study of needs and of the feasibility of offering efficient programs at reasonable cost. Generally, the satellite programs will take the form of extension courses or basic portions of pre-employment programs. When basic pre-employment programs are offered, care will be taken to make reasonably sure that students completing such programs will transfer to an appropriate Center for completion of their training.

17. Each curriculum, technical and trade, in each Center will gear into the *state-wide program* and contribute its part in meeting state-wide needs.

18. Specific *curriculums will be located in the most appropriate Center* or Centers, based upon consideration of local man-

power needs, state-wide manpower needs, other curriculums in the Center which supplement the specific curriculum, present offerings of the Center, and the like. In occupational fields which warrant the establishment of only one curriculum to serve the needs of the entire State, the Center in which this curriculum is located will be selected in the light of sources of students and various other factors which affect their recruitment, as well as the industrial employment in the area where the Center is located. Heavy concentration of specific industries in certain geographical areas may indicate the desirability of concentrating the training programs for these industries in those areas. In occupations where employment opportunity is state-wide and is sufficiently large, training programs for such occupations may well be established in most or all of the Centers.

19. *A few Centers will probably concentrate their efforts on technician training, and others on skilled crafts training.* Most of the Centers will offer skilled crafts training, with some of them also offering full two-year curriculums in appropriate technician fields and/or the first year of a two-year technician curriculum from which students will transfer to another Center for the second year of instruction.

20. *In determining whether a specific curriculum is to be offered* in a Center, consideration will be given to large pre-employment student potential, and to imminent industrial expansion, as well as to present employment opportunities.

21. *Undue duplication of curriculum offerings* by different Centers will be avoided, and each offering will be justified on the basis of determined needs.

22. In the situation which presently exists, in which Centers have been developed more largely on local initiative than on the basis of state-wide planning, it will probably be desirable to make some *changes in programs now offered or planned* to bring the total state-wide program in keeping with needs. This may necessitate some shifting of equipment from one Center to another.

23. *Instructional staff* for technician programs will require adequate backgrounds of technical training, technical experience, and appropriate teacher training. Instructors of skilled crafts and subjects will require adequate trade experience and appropriate teacher training. The qualifications of administrators of the Centers will be in keeping with the types of programs under their direction. Present staff members whose qualifications do not measure up to appropriate standards will be expected to make up the deficiencies. Opportunities for making up the deficiencies will be made available.

24. Effective functioning in the field of technician training requires *space and equipment* appropriate for this kind of training. Somewhat different types of space and equipment are required for skilled trades programs. The types of shops and laboratories needed, the equipment for these shops and laboratories, the library facilities, the number and types of classrooms required, and the drafting room facilities needed logically grow out of the specific content of the courses which make up the curriculums. Effort will be made to bring facilities into keeping with curriculum needs.

25. *The load factor of space and equipment* (the extent to which they are used to the maximum) will be kept sufficiently high to justify the offerings of the Center. Unused space, day and evening, will be kept to an appropriate minimum.

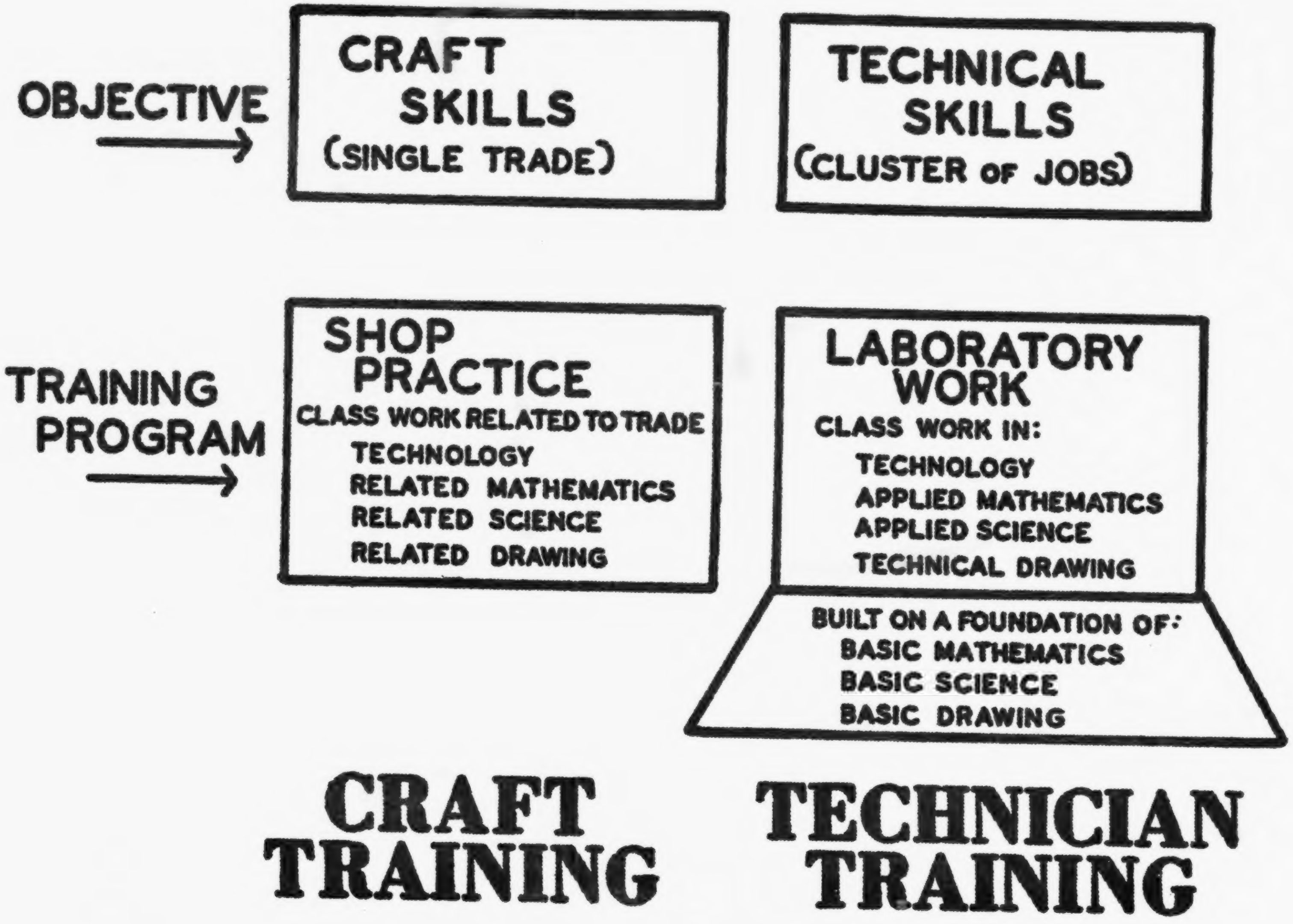
26. *Student selection* will be based upon standards determined for each curriculum. Procedures for the selection of students will include the use of appropriate standardized tests of potential aptitudes and abilities, as well as other measures.

27. An effective program of *student recruitment* will be developed with the purpose of reaching sufficient numbers of qualified students to fill the Centers to capacity.

28. Each Center will establish and maintain effective functional *relationships with the industries* it serves through its training programs.

29. Effective use will be made of appropriate *advisory committees* from industry, agriculture, and business.

30. *Effort will be made to provide instruction of the most efficient types,* utilizing effective instructional aids. Consideration will be given to the use of programmed learning and teaching machines, as well as other newer media of instruction.



OBJECTIVE

CRAFT SKILLS
(SINGLE TRADE)

TECHNICAL SKILLS
(CLUSTER of JOBS)

TRAINING PROGRAM

SHOP PRACTICE
CLASS WORK RELATED TO TRADE
TECHNOLOGY
RELATED MATHEMATICS
RELATED SCIENCE
RELATED DRAWING

LABORATORY WORK
CLASS WORK IN:
TECHNOLOGY
APPLIED MATHEMATICS
APPLIED SCIENCE
TECHNICAL DRAWING

BUILT ON A FOUNDATION OF:
BASIC MATHEMATICS
BASIC SCIENCE
BASIC DRAWING

CRAFT TRAINING

TECHNICIAN TRAINING

CHAPTER III

SUGGESTED TYPES AND PATTERNS OF CURRICULUMS

Pre-employment training in the Centers is provided in the form of organized curriculums. A curriculum may be defined as an integrated group of courses of appropriate types and lengths, arranged in proper sequence, and leading to a defined educational objective.

The objective of the curriculums of the post-high school *technician training* program is preparation for effective entrance into beginning or entry jobs in specific clusters or groups of closely related occupations of technician type. A definite curriculum is provided for each cluster, and is a distinct entity, although some of the basic courses of a curriculum may also find an appropriate place in one or more other curriculums.[*]

Pre-employment curriculums designed for the training of *skilled craftsmen* have as their objective the preparation of persons for effective entrance into a single skilled craft, in contrast with a cluster of occupations which is the goal of the technician curriculum.

Curriculums for the training of *technical specialists* are more restricted in scope than those for training highly skilled technicians. In some respects, they are similar to the latter in their pattern of organization, and may include some of the basic content of the technician curriculums. The objective of these curriculums is preparation for a single technical occupation or a narrow range of technician jobs.

Training for *skilled specialists* is usually provided through short, intensive programs of specialized shop work, which normally include relatively little in related technology.

TECHNICIAN TRAINING PROGRAMS

In planning curriculums for the training of technicians, it is desirable that the following principles underlying technical curriculums be kept in mind.

Principles Underlying Technical Curriculums[*]

1. The curriculum title describes it so clearly that it is easily identified and understood by employers and prospective students.
2. The range of content needed in preparation for the jobs in the cluster is reasonable for a two-year program beyond the high school.
3. The technical content lends itself to organized school instruction.
4. A substantial portion of the total curriculum content consists of technical courses peculiar to the job cluster, or basic thereto.
5. The difficulty level of the content is such that it can be mastered by a reasonably high proportion of the students within the time limits of the curriculum.
6. It will be feasible to secure, maintain, and keep up to date the special equipment needed for the curriculum.
7. The curriculum is built upon established entrance requirements for students, which may specify the completion of specified courses as well as high school completion.

Curriculum content for training programs for highly skilled technicians should provide adequate, intensive coverage of the technology peculiar to the occupational cluster, supported by basic technology, technology of closely related fields, and by appropriate mathematics, science, and drawing. General education of appropriate type should be included in each curriculum.

The word "technology" in a curriculum title is coming to be recognized as meaning a program at least two years in length, of high level, with content as outlined above, suited to the capacities of students somewhat above the average level of ability.

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[*] For further information on curriculum development for technician training, see: Lynn A. Emerson, *Technician Training Beyond the High School*, North Carolina State Department of Public Instruction, Raleigh, 1962.

[*] Adapted from Bulletin No. 1332, University of the State of New York, *A Guide to the Development of Programs for the Institutes of Applied Arts and Sciences*. Albany, 1947.

The amount of credit allowed for a specific course in a curriculum is usually expressed in semester-hours if the school year is divided into two semesters, or in quarter-hours if the school year has three terms. A semester varies in length in different institutions from 15 to 18 weeks; the term or quarter from 10 to 12 weeks. A semester-hour of credit requires one instructional class period per week for a semester, or equivalent effort in laboratory or shop work. It is generally assumed that a student needs to devote two hours of outside study for each hour spent in the classroom, or a total of three hours per week for a semester for each semester-hour of credit. Technical laboratory work usually requires some outside work in the preparation of reports, and where this outside work is substantial a credit hour is allowed for each two hours per week of laboratory work for a semester. Shop work usually requires no outside study, and the basis for credit is usually three hours of shop work per credit hour.

The total semester-hours of credit for two-year technician training varies somewhat in different institutions, from a minimum of 60 to a maximum of 80. It is suggested that curriculums developed for technician training in the Industrial Education Centers provide for at least 72 semester-hours of credit. This would average 18 credits per semester. If the institution operates on the term (quarter) basis rather than the semester, the total quarter-hour credits for an equivalent program would amount to 108, or 18 quarter-hours per term.

The usual curriculum pattern for technician programs provides that a considerable portion of the work of the first two terms consist of basic science, mathematics, and drawing, together with some special technology. Foundations must be laid for the more advanced courses. To maintain student interest in the program, some of the specialized technology needs to be offered during the early part of the curriculum, and a proper balance must thus be worked out between the basic courses and the technology. To the extent that it is practicable to do so, the curriculum content should be arranged so that the student who has to drop out of school after the first year has some marketable technical skill, such as drafting.

The beginning courses in the specific technology frequently do not require the extensive specialized equipment needed for the advanced courses. It is thus practicable to offer the first year of work in the technician curriculums in certain Centers which do not offer the advanced work, with the student transferring at the end of the first year to another Center which is equipped to handle the advanced instruction.

In some fields, such as mechanical technology or civil technology, the curriculum may be arranged in the form of options. All students may be required to take the same courses for the first two or three terms, then specialize in specific aspects of the field. The options in the civil technology curriculum might well include (a) building construction, and (b) highway and heavy construction.

Throughout the United States, the specific content included in certain curriculums, such as mechanical technology, varies widely. This is due partly to varying emphasis on different aspects of the technology in the industrial establishments where graduates find jobs, and partly to other causes. Curriculums in some institutions emphasize mathematics more than is the case with other institutions. Sometimes more emphasis is placed on science or drawing, and sometimes on the specific technology. Table 4 shows the differences found in the twelve curriculums included in the analysis. The curriculum pattern chosen for mechanical technology in the Industrial Education Centers, and this should be standardized throughout the State, may well look toward the median pattern as shown in this chart, with such deviations as seem necessary to meet the needs of the employment market of the Centers.

The Area Vocational Education Branch, Division of Vocational Education, U. S. Office of Education, which administers the Title VIII program of the National Defense Education Act, has contracted with outstanding institutions throughout the country for the development of suggested curriculums for the training of highly skilled technicians in two-year programs beyond the high school. Two such curriculums have been published, *Electrical Technology* and *Electronics Technology*, and others are being developed. The outlines of these suggested curriculums are shown in Appendix D. Full details concerning these curriculums are available in the publications of the U. S. Office of Education entitled Electrical Technology (Bulletin OE-80006) and Electronic Technology (Bulletin OE-80009). Similar bulletins in Mechanical Technology, Chemical Technology, and Data Processing are expected to be ready soon.

In the appendix are some material which may be useful in developing curriculum patterns for technician training, including the following:

a) A list of post-high school institutions which offer curriculums in specific fields. (See Appendix B.)

b) Comparative analyses of distribution of content by subject fields, in selected institutions, for instrumentation technology, electrical technology, and electronics technology. (See Appendix C.)

c) Sample curriculums in business data processing technology, electrical technology, electronic technology, mechanical technology, chemical technology, production technology, and highway technology. (See Appendix D.)

SKILLED CRAFTSMEN TRAINING PROGRAMS

Curriculums which provide training for skilled crafts occupations in institutions beyond the high school vary considerably in the range of content included and in the length of the programs. Some schools have programs two years in length, and others have shorter programs. In some cases the total content needed by a craftsman who is well trained in all the branches of his craft is broken down into segments, and training programs are offered which aim to develop competency only in a portion of the craft as a whole. In some skilled crafts, the range of content needed for mastery of the craft as a whole is broad, and the time required for the training program may be two years or more of full-time instruction. Other crafts require shorter periods.

A fully trained electrician, for example, needs the ability to install light and power wiring using varied types of materials, to install and connect motors of different types utilizing many kinds of starting devices, to diagnose trouble in electrical circuits and electrical equipment, to interpret mechanical and electrical drawings, to use electrical measuring instruments accurately and safely, to perform certain types of mechanical repairs

TABLE 4. Comparison of Mechanical Technology Curriculums Among Selected Two-Year Post-High School Programs Regarding the Number of Semester Hours Required for the Various Areas of the Curriculum.

SCHOOL	Mechanical Technology (including design and electives)	Mathematics	Science	Drawing (Basic)	General Education	Management	Total
Temple Univ. (Mech. Tech. Inst. Design)	50	10	3	4	3	2	72
Cogswell Polytechnic Coll., San Francisco	38	2	5	12	11	2	70
Oklahoma State Univ. Technical Institute	37	5	6	10	10	—	68
Broome Tech. Comm. Coll. Binghamton, N. Y.	35	8	7	2	12	2	66
Wentworth Inst., Boston (Metals Technology)	40	13	15	4	5	3	80
Arlington State College Arlington, Texas	30	9	7	6	14	3	69
Southern Tech. Inst. Chamblee, Georgia	32	7	7	5	8	16	75
Wentworth Institute (Production Technology)	33	11	8	4	7	17	80
Coffeyville College, Kansas	30	15	8	12	9	6	80
Charlotte College Charlotte, N. C.	26	7	12	5	10	17	77
Milwaukee Inst. of Tech. (Mech. Technol.-Design)	22	6	4	16	10	7	65
Milwaukee Inst. of Tech. (Mech. Technol.-Manufac.)	12	6	4	4	12	27	65
Median	32.5	7.5	7	5	10	4.5	71
Range	12—50	2—15	3—15	2—16	3—14	0—27	65—80

to electrical equipment, and the like. To develop the technical skills needed, he must study direct and alternating current circuits and machinery, basic electronics, electrical measuring instruments, wiring practices and codes, wiring diagrams, and many other things. Such study takes a considerable amount of time, since it must be supplemented with basic instruction in science, mathematics, and drawing, which are related to the craft. The length of the pre-employment curriculum for this craft may well be two years in length. Other skilled crafts which need this length of program include printing, auto mechanics, machine shop practice, air conditioning and refrigeration, and possibly others. Toolmaking may require a somewhat longer program.

A pre-employment training program of shorter length, perhaps one school year, is frequently utilized for those crafts which require certain types of training which are difficult to provide within the walls of the school. Among these are carpentry, plumbing and steamfitting, bricklaying and other trowel trades, and sheetmetal work. The training of the student is rounded out by apprenticeship or other patterns of on-the-job training. When proper relationships are established with employers and unions, credit toward apprenticeship may be given for training received in the school. Experience has shown that pre-apprenticeship training in a good vocational school lessens the drop-out rate for apprentices as compared with drop-out from apprenticeship when no full-time training is provided.

The training content of the curriculum designed to prepare persons for the skilled crafts is derived from job analysis. The curriculum is planned from data obtained from a detailed analysis of the understanding, manipulative skills, and technical skills of the worker in the particular craft for which the curriculum is designed. Usually, the tasks of the worker are analyzed in considerable detail, and from this analysis the curriculum is developed. Operations and jobs to be performed in the workshop are outlined, and related technical content is worked out and allocated to appropriate courses in mathematics, science, and drawing. Basic courses needed for understanding of the related technical content are devised. These various groups of instructional content are then organized in appropriate sequence, with suitable time allocations, to form an integrated curriculum.

TECHNICAL SPECIALIST TRAINING PROGRAMS

Instructional programs for the training of technical specialists and skilled specialists usually take the form of unit courses or a short series of inter-related courses. The content is derived from analysis of the occupation. Technical specialist training programs will probably be few in number, and usually will be offered to employed persons who desire to prepare themselves for such technical jobs as testers of specific materials or equipment, or inspectors of various types.

SKILLED SPECIALIST TRAINING PROGRAMS

Numerous jobs exist in the skilled specialist field, and some of them lend themselves well to pre-employment training in a Center. Knife grinder, knitting machine fixer, sewing machine repairman, tool-grinder operator, and upholsterer are examples of such jobs. Relatively short but intensive courses are utilized for the training, and the instruction is usually confined to a single shop.

EXTENSION TRAINING PROGRAMS

Extension courses for workers employed in industrial and technical occupations will comprise a substantial portion of the total enrollment in most of the Centers. These take the form of unit courses of relatively short length, or series of such courses, and will be offered at hours suited to the needs of the students who will include both day and shift workers. Often these courses are units of the long pre-employment courses, modified in length and content to meet the needs of the extension students. Others are developed specifically for extension training, and based upon analysis of the specific needs.

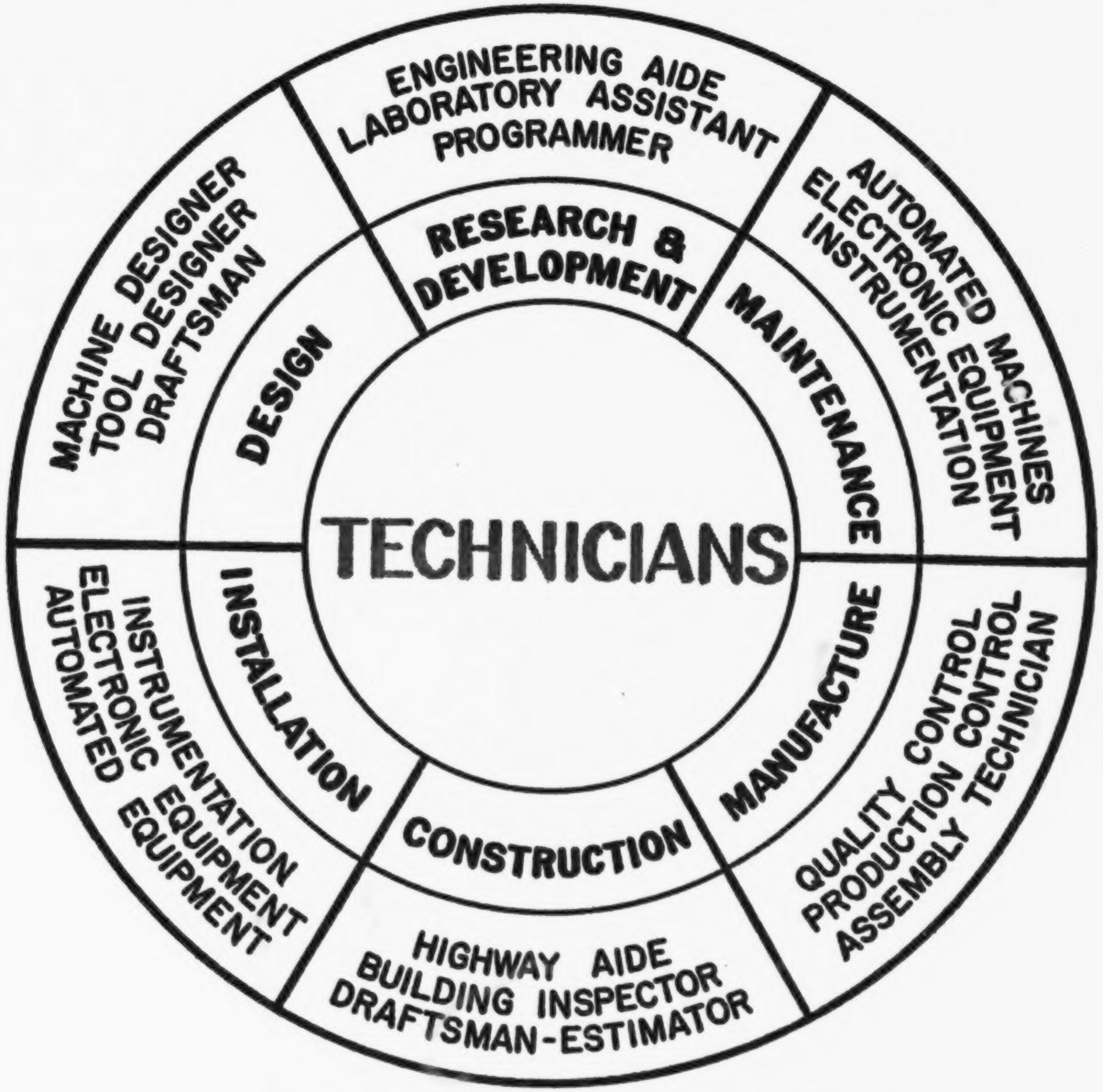
PART-TIME TRAINING PROGRAMS

Up to the present time, a relatively high proportion of the total student body has been made up of employed persons pursuing part-time programs, and high school students who spend half of their school hours in the Centers. As time goes on and the facilities and prestige of the Centers grow to new levels, it is probable that increasing numbers of high school graduates and others who have dropped out of high school will enroll in the Centers as full-time students. As this growth develops, the facilities for day-time instruction will be filled with high school graduates and adults, leaving little room for students still in high school. When that time arrives, the high school students for whom the Centers should provide training may well be limited to selected students who desire to continue their training in the Centers after they are graduated from high school, and for whom basic programs could be devised which would gear in with later study at the Centers.

Among the present program patterns in the Centers is the 15 hour per week pre-employment curriculum, which is offered during the day time and in the evening. This is designed to meet the needs of persons who must work part time. Students in these programs carry approximately half the normal full-time load, and thus will be required to attend classes for four years to complete the two-year full-time curriculums. This is a desirable phase of the total program, and steps may well be taken to make adequate provision for such students in the years ahead and to encourage enrollment on this basis.

If the Centers are to meet the training needs for persons of varying backgrounds and abilities, high school graduates, mature youth who have dropped out of high school, adults who are employed and who are unemployed, the over-all curriculum offerings will need to be varied in types and levels, and be scheduled to meet the needs of all. This is a large task, but with the resources of the Centers and the support accorded them it should be possible of accomplishment.

THE TECHNICIAN


TECHNICIANS
DESIGN
MACHINE DESIGNER
TOOL DESIGNER
DRAFTSMAN
RESEARCH & DEVELOPMENT
ENGINEERING AIDE
LABORATORY ASSISTANT
PROGRAMMER
MAINTENANCE
AUTOMATED MACHINES
ELECTRONIC EQUIPMENT
INSTRUMENTATION
MANUFACTURE
QUALITY CONTROL
PRODUCTION CONTROL
ASSEMBLY TECHNICIAN
CONSTRUCTION
HIGHWAY AIDE
BUILDING INSPECTOR
DRAFTSMAN-ESTIMATOR
INSTALLATION
INSTRUMENTATION
ELECTRONIC EQUIPMENT
AUTOMATED EQUIPMENT

IN INDUSTRY

CHAPTER IV

MANPOWER NEEDS OF NORTH CAROLINA INDUSTRY

This chapter deals chiefly with selected findings of the *North Carolina Study of Technical and Skilled Manpower*, which study was recently completed by the Employment Security Commission of North Carolina. Estimates of manpower needs which were obtained from other sources are discussed in the latter portion of the chapter.

Manpower needs are the bases on which all types of good occupational training programs, of whatever level, are developed. In planning the programs for the Industrial Education Centers, it was necessary that valid data on the manpower needs of North Carolina industry be secured. The need for a study of manpower requirements was discussed with the State Employment Security Commission, the most logical agency to conduct such a study. Out of an awareness of this need and other benefits which could be gained from such a study, it was initiated by the Commission. The Manpower Study was made by the Commission's Bureau of Employment Security Research under the direction of Hugh M. Raper, director, and David A. Garrison, assistant director of the Bureau, with immediate responsibility delegated to James C. French, supervisor of research studies.

The findings of the Manpower Study form a sound basis for the planning of training in the Industrial Education Centers. The methods used in making the study and the professional care in which it was executed make it especially valuable to educational planning. The thoroughness with which the survey forms were developed and tried out, the sampling procedures used, the well-organized training session for the analysts who did the interviewing, and the use of the interview method as opposed to the mailed questionnaire method strengthen the validity of the Manpower Study.

SELECTED FINDINGS OF THE NORTH CAROLINA STUDY OF TECHNICAL AND SKILLED MANPOWER

The Employment Security Commission of North Carolina has published the full results of its Manpower Study. Selected portions of the results are included in this section, and were taken from the report of the Manpower Study.*

One of the major purposes of the Manpower Study was to "provide the North Carolina State Board of Education with a set of guidelines for use by the Department of Curriculum Study and Research and Industrial Education Centers as an aid in planning curricula with the stated needs of industry."

Methods of Conducting the Manpower Study

To best determine industry's future manpower requirements for technicians and selected skilled craftsmen, Employment Security Commission labor market analysts interviewed management representatives in a sample comprised of more than 1,200 establishments found in 24 of North Carolina's important industries. This sample accounted for nearly 62 per cent of total employment in the industry divisions studied and represented 10,078 firms.

Data were collected throughout the State by a team of Employment Security Commission labor market analysts who were given special instructions in survey methods, procedures, and objectives. The analysts recorded data on three types of schedules which were identified as (1) Employer Data Sheet, (2) Technician Data Sheet, and (3) Skilled Data Sheet.

The discussion of occupational scope and industrial scope which follows is adapted from the report of the Manpower Study. This represents a portion of a thorough treatment of methodology which is included in the report of the Manpower Study.

Occupational Scope—Technicians

The survey of technical occupations was "open-ended". To facilitate identification of all possible technical occupations the following supplements to the survey instrument were used as guides.

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* *North Carolina Study of Technical and Skilled Manpower.* Employment Security Commission of North Carolina, Bureau of Employment Security Research, Raleigh, 1962.

(a) A prepared list of definitions referred to as "Some Typical Technical Occupations." The DICTIONARY OF OCCUPATIONAL TITLES was used as a basis for development of listed technician definitions. Some technician definitions were developed for survey purposes from related, combined, or parts of specific definitions listed in the D. O. T. (See Appendix F for definitions.)

(b) *A general description of technician-level work entitled, "Definition of Technician."* (See Appendix E.)

(c) A third measure of technician-level work was stated on the questionnaire which indicated *basic minimum criteria for identifying a technical occupation as follows:*

- The occupation lies between that of a skilled craft and a scientific profession.
- The occupation requires technical competency based upon specialized, intensive training in technical subjects involving the direct application of functional aspects of related sciences and mathematics.
- The occupation is one in which most of the person's work is concerned with the application of technical knowledge and technical understanding in contrast with manipulative skills.
- The occupation is one for which adequate technical training can usually be provided in vocational-technical programs on the secondary level, extension programs for out-of-school-youths and adults on a full-time basis, or terminal technical courses at the post-high school level of not more than two years in length.

Through application of the above-named tools for defining the technician level of work, 55 different jobs were identified. In addition, 11 other positions were identified as being of a technical nature, but are not included in the report because these jobs were highly specialized and involved relatively few workers.

Occupational Scope—Skilled Occupations

In addition to the study of technicians, 32 skilled occupations for which there was a known general shortage of workers, were selected and defined for inclusion in the occupational scope of the survey. Skilled occupations were selected for study on the basis of the following considerations.

Occupations which were considered numerically important to the industrial composition of the North Carolina labor market.

Jobs which were known or expected to be in short supply.

Types of work requiring an extended period of vocational education or industrial training.

Application of the above criteria resulted in the pre-selection for study of 32 skilled crafts. Included in this number were 11 jobs which generally crossed industry lines. These jobs were considered in all of the industries surveyed. The remaining 21 selected skilled jobs were characteristic of specific industries and were, therefore, surveyed from lists of definitions especially prepared for use in the appropriate industries. Prelisted skilled occupation titles and definitions used in the study are shown in Appendix G.

Industrial Scope of Study

The Manpower Study was made to obtain a measure of technical and selected skilled manpower resources and training needs of a substantial cross-section of North Carolina's industrial complex. Time and cost were factors which dictated that limitations be placed on the scope of the study. Despite some necessary restrictions to coverage, it is believed that the study provides a realistic and valid measure of minimum future needs in North Carolina for workers trained in the occupations studied.

Survey findings do not represent estimates of total manpower requirements for the State because not all industries and occupations could be included in the coverage. References in this report to "North Carolina" or to "statewide" survey findings, therefore, apply only to the selected industries which comprise the survey scope and which are identified in detail in Table 5. Likewise, no reliable occupational estimates can be provided which take into account additional labor demands resulting from future acquisition by the State of new industrial establishments —and these number into the hundreds each year. The North Carolina Study of Technical and Selected Skilled Manpower Resources represents, therefore, a conservative appraisal of future training needs.

It was not practical to survey industrial divisions such as finance, insurance and real estate; lumber and wood products; wholesale and retail trade; and the major portion of the service industry. These industries are generally characterized by hundreds of relatively small employing units. Since the interview approach was used, it was thought to be economically prohibitive to contact in these groups the volume of firms necessary for adequate sample coverage.

Certain segments or sub-divisions of some industries studied were also excluded from coverage and are described in footnotes to Table 5. These exclusions were made because they involve activities which employ very high percentages of workers in unskilled and semiskilled occupations not embraced by this particular study.

Agriculture, State and federal government, and non-profit organizations were not covered by the survey because appropriate base data were lacking for systematic sample selection and statistical processing.

Table 5 shows a comparison between sample employment representation and employment in all firms encompassed by the total survey scope. Actual employment in the 1,221 sampled firms accounted for nearly 62 per cent of total employment in the industry divisions studied. Data collected from the sampled establishments were inflated to estimates representing 10,078 firms doing business in North Carolina on June 15, 1960. At that time, the firms which comprised the total study scope employed considerably more than one-half million workers. Information with respect to sample firm selection, data collection and processing techniques used are included in more detail in the report of the Manpower Study.

Survey Findings—Technical Occupations

The report of the Manpower Study identifies 55 separately defined technicians and shows various findings about them. Definitions of these identified technicians are included in Appendix F of this publication.

Some of the key findings of the Manpower Study pertinent to technical educational planning are shown in Table 6. Information in this table, taken from the report of the Manpower Study, shows the total employment for the various technical occupations in June, 1961, and estimates of the number of technicians to be trained by industry and by educational institutions by the years June, 1963 and June, 1966. The number of technicians to be trained and employed by industry by these years is based on industry's estimates of expansion, and the normal rates of attrition for the currently employed technicians. If expansion plans of employers for the next five years (by June, 1966) are to be met and replacements are to be provided, nearly 82 per cent of all technicians needed will require institutional training. One of the most significant conclusions to be drawn from this analysis is the fact that by June, 1966, more than 6,800 individuals will need to be provided with from one to two years of institutional training, if expectations of only those employers encompassed by the Manpower Study materialize.

Data in Table 6 are shown by technology areas as well as by individual technician occupations. In determining the technologies, individual technician occupations were grouped in accordance with similarities in job content which seemingly relate to a particular technology or field of work.

Survey Findings—Skilled Occupations

In addition to the 55 surveyed technician occupations which are discussed in this chapter, 32 selected skilled occupations were surveyed. Definitions for these skilled occupations are shown in Appendix G.

Information in Table 7, taken from the report of the Manpower Study, shows the same types of data for skilled occupations as is included in Table 6 for technician occupations. Listed in the table are the eleven skilled occupations which were surveyed in all industries covered in the survey and the remaining 21 occupations which were surveyed only in selected industries. For each occupation, information is presented on the number of skilled workers whom industry expects to train on the job by the target dates June, 1963 and June, 1966. Also shown is the number of workers who will need to be trained outside of industry by the target dates in order that anticipated additional workers needed may be supplied.

Each occupation should be viewed independently with respect to institutional vocational training needs. For example, the tex-

TABLE 5. Industrial Scope of Study and Per Cent of Employment Covered By the Sample—June, 1960

Statewide Totals—June, 1960		Standard Industrial Classification[1]		Statewide Sample Coverage—June, 1960		
Number of Establishments	Number of Workers Employed	Code	Industry Title	Sampled Establishments	Sampled Employment	Sampled Employment as a per cent of total employment
10,078	590,632	XXXX	All Industry Divisions Surveyed	1,221	364,344	61.7%
3,853	456,159	XXXX	Manufacturing Industries	668	286,997	62.9%
846	33,902	20	Food and Kindred Products	115	18,159	53.6%
7	23,968	21	Tobacco Manufactures[2]	7	23,968	100 %
1,041	222,445	22	Textile Mill Products	136	125,495	56.4%
255	35,710	23	Apparel	58	19,786	55.4%
409	44,596	25	Furniture and Fixtures	57	24,174	54.2%
91	14,418	26	Paper and Allied Products	32	12,415	86.1%
330	8,864	27	Printing and Publishing	43	5,007	56.5%
113	10,918	28	Chemicals and Allied Products[3]	16	9,129	83.6%
28	2,341	30	Rubber Products	19	2,288	97.7%
54	4,709	32	Clay and Glass Products[4]	33	3,936	83.6%
39	2,462	33	Primary Metal Industries	15	1,978	80.3%
165	7,459	34	Fabricated Metal Products	23	4,123	55.3%
262	11,859	35	Machinery, except Electrical	40	7,243	61.1%
53	24,924	36	Electrical Machinery	27	23,338	93.6%
64	4,700	37	Transportation Equipment	17	3,614	76.9%
9	741	38	Instruments	6	726	98.0%
87	2,143	39	Miscellaneous Manufacturing	24	1,618	75.5%
6,225	134,473	XXXX	Nonmanufacturing Industries	553	77,347	57.5%
4,436	62,637	15-17	Construction	211	22,624	36.1%
1,135	29,547	41-47	Transportation (except R. R.)	98	17,198	58.2%
262	13,446	48	Communications	54	11,144	82.9%
122	9,705	49	Other Utilities	36	7,803	80.4%
13	289	739	Selected Business Services	13	289	100 %
168	1,590	891	Engineering Services	52	1,030	64.8%
89	17,259	93	Local Government[5]	89	17,259	100 %

[1] Establishments classified by types of industrial activity as defined in the STANDARD INDUSTRIAL CLASSIFICATION MANUAL, 1957, U. S. Bureau of the Budget.

[2] Excluding establishments primarily engaged in tobacco stemming and redrying—SIC Code 214. [3] Excluding establishments primarily engaged in manufacturing and mixing agricultural fertilizers—SIC Codes 2871 & 2872. [4] Excluding establishments primarily engaged in manufacturing nonmetalic mineral products—SIC Codes 326, 327, 328 & 329. [5] Excluding all unincorporated towns and all municipalities with 1960 population of less than 3,000.

TABLE 6. Vocational Training Requirements for Technician Occupations By June, 1963, and June, 1966

Occupation Title	Employment June, 1961	Expansion Plus Attrition—Additional Workers Needs by: June, 1963	Expansion Plus Attrition—Additional Workers Needs by: June, 1966	Plant Training Output by: June, 1963	Plant Training Output by: June, 1966	Net Outside Training Needs by: June, 1963	Net Outside Training Needs by: June, 1966
All Technicians	14,162	4,592	8,337	951	1,534	3,668	6,803
Chemical Technology	1,536	569	1,014	64	111	505	903
Chemist Assistant	1,223	483	870	53	95	430	775
Cloth Tester	23	3	8	2	3	1	5
Grey-Goods Tester	39	25	35	1	2	24	33
Laboratory Tester, Food	181	41	67	6	7	35	60
Paint Tester	22	4	5	1	2	3	3
Scientific Helper	48	13	29	1	2	12	27
Civil and Construction Technology	2,763	930	1,716	183	318	747	1,398
Civil and Construction Technician	464	98	220	12	28	86	192
Building Inspector	98	23	51	2	4	21	47
Draftsman, Structural	584	266	459	19	63	247	396
Draftsman, Topographical	194	80	200	26	42	54	158
Estimator (nonmanufacturing)	1,090	349	540	76	120	273	420
Instrument Man	333	114	246	48	61	66	185
Data Processing Technology	227	101	157	32	46	69	111
Programmer	111	40	65	17	21	23	44
Project Planner, Data Processing	60	31	43	13	16	18	27
Systems Analyst	56	30	49	2	9	28	40
Electrical and Electronics Technology	2,045	524	1,124	46	124	478	1,000
Electric Power Technician	152	49	101	21	39	28	62
Electronics Technician	639	166	350	10	39	156	311
Draftsman, Electrical	827	140	409	2	18	138	391
Laboratory Assistant	44	18	30	9	18	9	12
Radio/TV Transmitting Technician	355	125	200	4	10	121	190
Specification Writers, Electrical Devices	28	26	34	0	0	26	34
Designers	207	135	185	2	7	133	178
Cloth Designer	104	53	64	1	5	52	59
Clothes Designer	8	43	46	0	1	43	45
Fixture Designer	64	33	65	0	0	33	65
Furniture Designer	31	6	10	1	1	5	9
Industrial Technology	3,602	1,100	2,010	311	472	789	1,538
Industrial Technician	856	290	503	25	38	265	465
Cost Technician	1,006	280	529	95	162	185	367
Estimator (manufacturing)	160	51	79	11	18	40	61
Process-Description Writer	142	18	35	4	4	14	31
Production Planner	853	243	540	131	191	112	349
Time-Study Man	504	143	226	43	56	100	170
Writer, Technical Publications	81	75	98	2	3	73	95

(Continued)

Table 6. (continued)

Occupation Title	Employment	Expansion Plus Attrition—Additional Workers Needs by:		Plant Training Output by:		Net Outside Training Needs by:	
	June, 1961	June, 1963	June, 1966	June, 1963	June, 1966	June, 1963	June, 1966
Mechanical Technology	1,388	482	875	71	138	411	737
Mechanical Technician	270	94	186	37	79	57	107
Air-Conditioning and Refrigeration Tech.	84	40	74	13	19	27	55
Die Designer	21	1	10	1	4	0	6
Draftsman, Mechanical	828	278	495	17	33	261	462
Safety Technician	96	11	32	2	2	9	30
Tool Designer	89	58	78	1	1	57	77
Metal Technology	151	109	155	4	10	105	145
Laboratory Assistant Metallurgical	12	4	13	1	2	3	11
Sheet-Metal Technician	72	45	58	2	5	43	53
Tester	21	9	17	0	0	9	17
Welding Technician	35	46	58	0	2	46	56
X-Ray Technician Industrial	11	5	9	1	1	4	8
Quality Control and Physical Testing	1,314	259	455	96	141	165	314
Quality Control Technician	272	85	149	24	29	61	120
Cloth Tester, Quality	84	10	17	7	9	3	8
Laboratory Tester, Cotton	336	79	118	31	50	48	68
Laboratory Tester, Synthetic Fiber	25	6	15	1	1	5	14
Paper Tester	133	10	22	11	12	1	10
Yarn Tester	464	69	134	22	40	47	94
Miscellaneous Technicians	929	383	646	142	167	265	479
Clerical Technician	395	148	262	15	21	133	241
Commercial Artist	293	110	221	13	26	97	195
Mathematics Technician	23	16	23	0	0	16	23
Fingerprint Classifier	46	10	18	5	7	5	11
Sanitation Technician	17	2	6	0	0	2	6
Instructor of Trainees	155	97	116	109	113	12	3

TABLE 7. Vocational Training Requirements for Skilled Occupations By June, 1963, and June, 1966

Occupation Title	Employment	Expansion Plus Attrition—Additional Worker Needs By:		Plant Training Output By:		Net Outside Training Needs By:	
	June, 1961	June, 1963	June, 1966	June, 1963	June, 1966	June, 1963	June, 1966
All skilled occupations surveyed	58,991	14,762	29,558	5,735	11,507	9,027	18,051
Occupations surveyed in all industries	23,490	7,196	13,567	2,254	4,873	4,942	8,694
Air-Cond. and Refrigeration mechanic	1,143	346	616	87	157	259	459
Electrician	8,047	1,462	3,233	816	1,721	646	1,512
Heat Treater	142	102	209	19	41	83	168
Machinist	4,610	1,422	2,905	479	1,050	943	1,855
Molder-Coremaker	714	117	259	61	164	56	95
Pipe-steam fitter	2,645	882	1,788	256	646	626	1,142
Plater	205	85	194	22	39	63	155
Sheet-metal worker	2,667	1,624	2,290	317	656	1,307	1,634
Tool and die maker	539	236	433	41	98	195	335
Tool grinder operator	142	85	182	6	19	79	163
Welder	2,636	835	1,458	150	282	685	1,176
Occupations surveyed in Textile Industry	10,574	1,941	3,775	1,895	3,721	46	54
Knitting-machine fixer	3,610	1,296	2,222	1,195	2,314	101	–92
Loom Fixer	4,527	367	888	516	1,078	–149	–190
Spinning-frame fixer	1,954	236	525	103	201	133	324
Master Dyer	483	42	140	81	128	–39	12
Occupations surveyed in furniture industry	7,037	2,514	4,034	632	1,024	1,882	3,010
Cabinetmaker	1,810	621	922	135	165	486	757
Finisher, furniture	1,650	465	810	51	104	414	706
Knife grinder	156	42	72	22	29	20	43
Pattern Maker, furniture	124	24	60	8	13	16	47
Upholsterer	3,297	1,362	2,170	416	713	946	1,457
Occupations surveyed in apparel and textiles	944	392	662	113	170	279	492
Pattern Maker, Cloth	128	95	111	12	16	83	95
Pattern Cutter	109	24	48	16	28	8	20
Sewing-Machine Repairman[1]	707	273	503	85	126	188	377
Surveyed in Paper Printing and Publishing	2,371	485	1,172	182	384	303	788
Cutting and Creasing Pressman	204	37	98	41	87	–4	11
Offset-Pressman	386	132	324	35	60	97	264
Photolithographer	118	36	124	9	24	27	100
Printer	1,663	280	626	97	213	183	413
Machine-adjuster-fixer (tobacco)	718	76	162	63	115	13	47
Baker (Food)	422	82	156	36	63	46	93
Surveyed in nonmanufacturing industries	13,435	2,076	6,030	560	1,157	1,516	4,873
Carpenter (construction only)	10,903	1,313	4,574	437	930	876	3,644
Diesel Mechanic	1,207	441	840	62	119	379	721
Truck Mechanic	1,325	322	616	61	108	261	508

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[1] Sewing-Machine Repairman was also surveyed in furniture, and data shown represent the combined needs of apparel, textile, and furniture industries.

tile industry has on-the-job training programs underway or planned which are expected to provide the State with enough knitting-machine fixers and loom fixers to meet the five-year requirements. On the other hand, projected on-the-job training in the group of skills which were studied in all industries will fall nearly 8,700 workers short of the anticipated need by June, 1966. For the studied skilled occupations found in furniture, the industry expects to train no more than one-fourth of the number needed by 1966; and, planned on-the-job training in nonmanufacturing is expected to furnish less than 20 per cent of the surveyed trained worker requirements by June, 1966.

If industry in North Carolina is to grow at the rate indicated by the Manpower Study for the categories studied, industrial training will have to be provided for about 18,050 persons in the 32 skills surveyed—over-and-above some 11,507 workers industry plans to train on the job.

Area Apportionment of State-wide Survey Findings

Selected State-wide survey data were distributed by area in the Manpower Study. The map in Figure 2 shows boundaries of the six areas of the State which were designated for the purpose of area apportionment of the findings.

Information in Tables 8 and 9 is taken from the report of the Manpower Study. In Table 8, the technician occupations which were identified in the Manpower Study are listed. Shown for each occupation are estimates of the number of workers expected to require vocational training from sources other than industry-provided training for each of the six areas of the State. Table 9 shows the same institutional training needs data for the 32 skilled occupations studied.

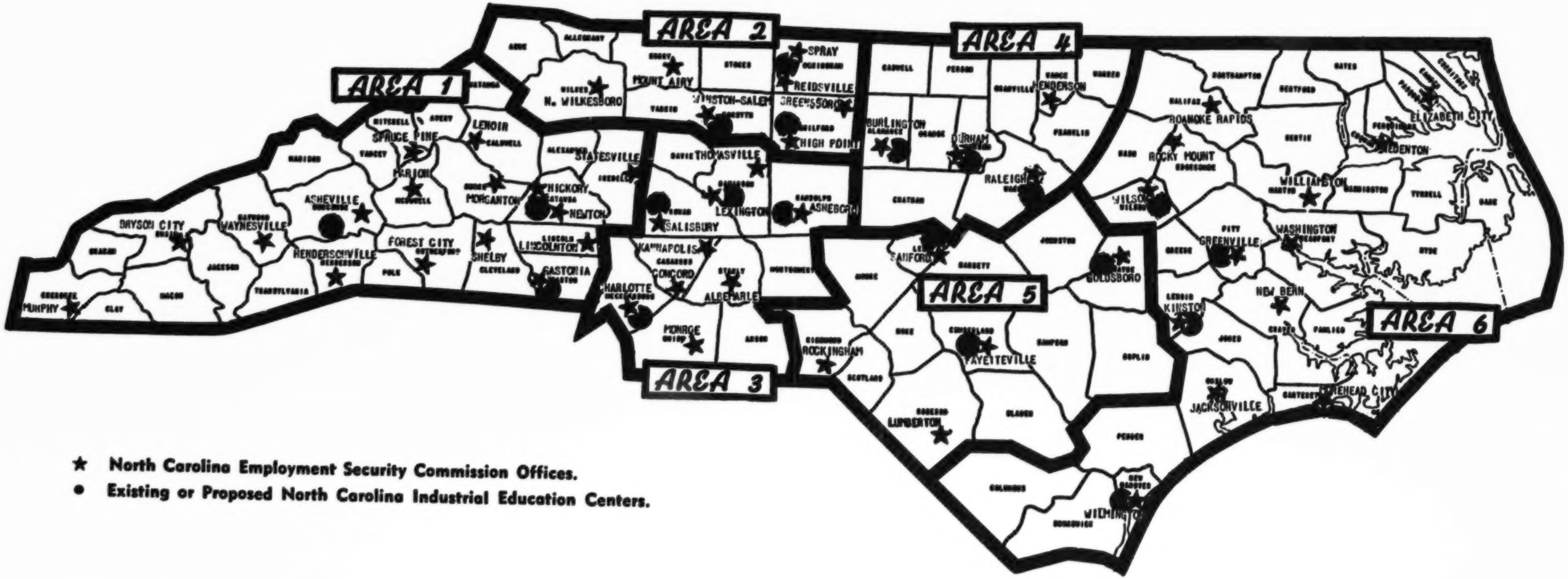
AREA 1
AREA 2
AREA 3
AREA 4
AREA 5
AREA 6
MURPHY
BRYSON CITY
WAYNESVILLE
ASHEVILLE
HENDERSONVILLE
SPRUCE PINE
MARION
LENOIR
MORGANTON
FOREST CITY
SHELBY
HICKORY
NEWTON
LINCOLNTON
GASTONIA
STATESVILLE
N. WILKESBORO
MOUNT AIRY
WINSTON-SALEM
THOMASVILLE
LEXINGTON
SALISBURY
KANNAPOLIS
CONCORD
CHARLOTTE
MONROE
ALBEMARLE
ASHEBORO
SPRAY
REIDSVILLE
GREENSBORO
HIGH POINT
BURLINGTON
DURHAM
HENDERSON
RALEIGH
SANFORD
ROCKINGHAM
FAYETTEVILLE
LUMBERTON
GOLDSBORO
WILMINGTON
ROANOKE RAPIDS
ROCKY MOUNT
WILSON
KINSTON
GREENVILLE
WILLIAMSTON
WASHINGTON
NEW BERN
JACKSONVILLE
MOREHEAD CITY
EDENTON
ELIZABETH CITY
★ North Carolina Employment Security Commission Offices.
● Existing or Proposed North Carolina Industrial Education Centers.

FIGURE 2. Areas of State Designated for Distribution of State-wide Survey Findings

TABLE 8. Area Distribution of Net Training Requirements for Technician Occupations By June, 1966

Technician Occupation Title	Statewide Net Training Requirements[1]	Distribution of Statewide Net Training Requirements Area 1	Area 2	Area 3	Area 4	Area 5	Area 6
Totals for all Technicians	6,803	1,791	1,622	1,421	849	463	596
Air-Conditioning and Refrigeration technician	55	15	13	12	6	4	5
Building Inspector	47	8	9	11	8	4	7
Chemist Assistant	775	216	182	168	89	52	68
Civil and Construction Technician	192	29	47	46	30	13	27
Clerical Technician	241	67	57	52	28	16	21
Cloth Designer	59	20	11	17	6	3	2
Cloth Tester	5	[2]	[2]	[2]	[2]	[2]	[2]
Cloth Tester, quality	8	[2]	[2]	[2]	[2]	[2]	[2]
Clothes Designer	45	18	8	6	2	4	7
Commercial Artist	195	63	45	41	19	13	14
Cost Technician	367	101	86	80	42	25	33
Die Designer	6	[2]	[2]	[2]	[2]	[2]	[2]
Draftsman, Electrical	391	83	148	21	101	33	5
Draftsman, Mechanical	462	148	107	97	46	31	33
Draftsman, Structural	396	110	93	86	45	27	35
Draftsman, Topographical	158	24	38	38	25	11	22
Electric Power Technician	62	9	15	15	10	4	9
Electronics Technician	311	87	73	67	36	21	27
Estimator (manufacturing)	60	19	14	13	6	4	4
Estimator (nonmanufacturing)	421	64	102	100	67	29	59
Fingerprint Classifier	11	[2]	[2]	[2]	[2]	[2]	[2]
Fixture Designer	65	32	18	10	2	3	—
Furniture Designer	9	5	3	1	—	—	—
Grey-goods Tester	33	11	6	9	4	2	1
Industrial Technician	465	130	109	101	53	31	41
Instructor of Trainees	3	[2]	[2]	[2]	[2]	[2]	[2]
Instrument Man	185	28	45	44	29	13	26
Laboratory Assistant	12	4	3	2	1	1	1
Laboratory Assistant, metallurgical	11	[2]	[2]	[2]	[2]	[2]	[2]
Laboratory Tester, cotton	68	23	12	19	7	4	3
Laboratory Tester, food	60	9	11	12	9	9	10
Laboratory Tester, synthetic fiber	14	5	2	4	1	1	1
Mathematics Technician	23	7	5	5	2	2	2
Mechanical Technician	107	30	25	23	12	7	10
Paint Tester	3	[2]	[2]	[2]	[2]	[2]	[2]
Paper Tester	10	5	1	1	—	—	3
Process-Description writer	31	10	7	7	3	2	2
Production Planner	349	112	81	73	35	23	25
Programmer	44	14	10	9	5	3	3
Project planner, data processing	27	8	6	6	3	2	2
Quality Control Technician	120	38	28	25	12	8	9
Radio/TV Transmitting Technician	190	29	46	45	30	13	27
Safety Technician	30	8	7	7	3	2	3
Sanitation Technician	6	[2]	[2]	[2]	[2]	[2]	[2]
Scientific Helper	27	9	6	5	3	2	2
Sheet-Metal Technician	53	8	13	13	8	4	7
Specification writer, electrical devices	34	10	8	7	4	2	3
Systems Analyst	40	13	9	8	4	3	3
Tester	17	5	4	4	2	1	1
Time-study man	170	55	39	36	17	11	12
Tool Designer	77	25	18	16	8	5	5
Welding Technician	56	16	13	12	6	4	5
Writer, technical publications	95	30	22	20	10	6	7
X-Ray Technician Industrial	8	[2]	[2]	[2]	[2]	[2]	[2]
Yarn Tester	94	31	17	27	10	5	4

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[1] Net training requirements carried over from Table 6—total additional workers needed, less expected plant-training output. [2] Too few to distribute by area.

TABLE 9. Area Distribution of Net Training Requirements for Skilled Occupations By June, 1966

Skilled Occupation Title	Statewide Net Training Requirements[1]	Distribution of Statewide Net Training Requirements					
		Area 1	Area 2	Area 3	Area 4	Area 5	Area 6
All skilled occupations surveyed	18,333	4,801	4,605	3,883	2,118	1,189	1,714
Air-Conditioning and Refrigeration mechanic	459	128	107	100	53	31	40
Baker	93	13	17	19	14	14	16
Cabinet Maker	757	377	199	116	23	36	6
Carpenter	3,644	550	1,042	758	536	248	510
Cutting and creasing pressman	11	[2]	[2]	[2]	[2]	[2]	[2]
Diesel Mechanic	721	97	189	196	109	53	77
Electrician	1,512	293	363	350	218	102	186
Finisher, Furniture	706	351	186	108	21	34	6
Heat Treater	168	54	39	35	17	11	12
Knife Grinder	43	22	11	7	1	2	—
Knitting-Machine Fixer		[3]	[3]	[3]	[3]	[3]	[3]
Loom Fixer		[3]	[3]	[3]	[3]	[3]	[3]
Machine-Adjuster-Fixer	47	—	38	—	9	—	—
Machinist	1,855	567	431	394	196	124	143
Molder-Coremaker	95	30	22	20	10	6	7
Master Dyer	12	[2]	[2]	[2]	[2]	[2]	[2]
Offset-Press Man	264	38	68	75	40	19	24
Pattern Cutter	20	8	3	3	1	2	3
Pattern Maker, cloth	95	39	17	12	5	8	14
Pattern Maker, furniture	47	24	12	7	2	2	—
Photolithographer	100	15	26	28	15	7	9
Pipe-steam fitter	1,142	215	275	264	167	78	143
Plater	155	50	36	33	15	10	11
Printer	413	60	106	117	63	29	38
Sewing-Machine Repairman	377	146	70	71	27	26	37
Sheet-Metal Worker	1,634	341	391	373	227	111	191
Spinning-Frame Fixer	324	108	59	91	34	19	13
Tool and Die Maker	335	108	77	70	34	22	24
Tool-Grinder Operator	163	52	38	34	16	11	12
Truck Mechanic	508	77	123	121	81	35	71
Upholsterer	1,457	725	383	223	44	70	12
Welder	1,176	313	277	258	140	79	109

[1] Net training requirements carried over from Table 7—Total additional workers needed, less expected plant-training output.

[2] Statewide net training requirements are too few to distribute by area.

[3] Plant-training output is expected to exceed the statewide demand.

Area Distribution of Production Technicians

Data on the numbers of production technicians (shown in the Manpower Study as industrial technicians) needed annually and listed by industries as well as by areas were not available directly from the Manpower Study. Table 10 is a summary of such data. The table was derived by taking the total number of such technicians needed in the State as a whole, by industry groups, and by dividing these among the six areas in proportion to the total employment in the various industries in these areas.

The distribution of production technicians needed annually, by industry and by area, is helpful in determining the number and types of production technology curriculums and curriculum options that are needed in the State to supply the manpower demands. The area distribution of data is useful in deciding where in the State the curriculums might most feasibly be provided.

TABLE 10 Numbers of Production Technicians Needed Annually, By Industries, By Areas

Industry	State Total	Area					
		I	II	III	IV	V	VI
Food and kindred products	35	5	6	7	5	5	6
Textile mill products	78	25	15	20	9	6	3
Apparel	28	7	6	6	1	3	5
Furniture & fixtures	26	13	6	5	1	1	0
Printing and publishing	11	2	3	3	2	0	1
Fabricated metals & machinery	52	14	11	12	3	7	5
Electrical machinery	47	8	19	3	13	3	1

Some Additional Highlights of the Manpower Study

The Employment Security Commission report of the Manpower Study provides information and analyses of data on several aspects of manpower resources and requirements which are not included in this report. Only those data from the Manpower Study which were especially useful in developing Chapters VI and VII are included.

Following are some additional areas which are covered in the Manpower Study.

Conclusions and Recommendations

Among other conclusions and recommendations, the following was stated in the study.

> "The State should continue to pursue with vigorous efforts programs to promote the use of all sources of manpower and to eliminate barriers to the training and employment of older persons, women, and members of minority races. Accomplishment of this difficult objective would favorably reduce the hardships of unemployment, costs of unemployment compensation and public assistance, and could raise considerably North Carolina's position among states in per capita income."
>
> "Youth counseling and guidance services should be expanded and strengthened in public and private schools at junior and senior high school levels, and in post-high-school institutions, including Industrial Education Centers. Vocational guidance programs of the public employment service should stress back-to-school advantages to job applicants lacking vocational preparation."

Anticipated Expansion of Employment

A series of charts presents for each technician and skilled occupation studied a comparison of 1961 employment to the number of workers employers anticipate having on their payrolls by June, 1963 and June, 1966. Also in the report are tables which show the anticipated employment expansion for technician occupations and for skilled occupations, by industry.

Minimum Education and Experience Hiring Requirements for Technician Occupations

Desired educational background for the various technicians varied from high school graduation to college graduation. About two-thirds of the positions required one or another type of education beyond the high school, with post-high-school vocational education being the predominant type required. Generally, as the educational requirement increased, the requirement for previous work experience decreased.

The types of training programs now offered in the Centers, and the additional offerings as proposed in the present study, appear to satisfy the educational requirement for most of the occupations surveyed.

Sex Preference

The survey was designed to obtain some measure of technician employment opportunity for women. The report indicates that women, if properly trained, could qualify to fill about 26 per cent of all the technician positions reported by the 1,221 employers interviewed. Only ten of the 55 technician positions studied were limited to men only.

ESTIMATES OF NUMBERS NEEDED IN SELECTED OCCUPATIONAL FIELDS IN ADDITION TO THOSE REPORTED IN THE MANPOWER STUDY

As indicated earlier in this report, it was necessary that the industrial scope of the Manpower Study be limited because of cost, time, and other factors. Not included in the study were such industrial divisions as finance, insurance and real estate; lumber and wood products; wholesale and retail trade; major portion of the service industry; agriculture; and State and Federal Government. Extensive, additional surveys are needed to determine opportunities for employment in these fields, including new industries entering the State.

The Curriculum Study staff obtained some additional information on needs in selected fields with which present programs in the Centers are concerned.

(a) Data were obtained on estimated numbers of automobile mechanics needed.

(b) Information was secured on the present and probable future needs in the field of data processing.

(c) Information was secured on the estimated numbers of new workers needed in cosmetology and practical nursing.

(d) Data were obtained on employment in technical and skilled occupations in State government.

The information secured has been incorporated with the data from the Manpower Study in developing the tables in Chapters VI and VII, showing the numbers of workers needed from which the scope and size of training programs required to meet these needs were estimated.

The influx of new industries into North Carolina was studied. In some of these industries the additional employment created is substantial. Substantial increases in total employment are noted in such fields as furniture manufacturing, chemicals, and metal working establishments, and rapid growth in the apparel manufacturing field.

TRAINING FOR MANPOWER DEMANDS

Study of the occupations included in the Manpower Study reveals wide variations in the qualifications and training required. Many of the technician occupations are of the engineering technician type, requiring a training program of two years of full-time, rigorous training beyond the high school. Others of these occupations are of the technical specialty type, requiring highly specialized training which can be provided in a few months or even in a few weeks. Some of the skilled crafts occupations require extended training programs to develop competency. Many of the skilled specialty occupations require relatively short training periods.

The requirement for previous experience in the occupation in order to secure employment, or work experience in a related occupation, indicates the need for a large amount of extension training for employed workers, of types which will upgrade them on present jobs or prepare them for new jobs.

To meet the needs as revealed in the findings of the Manpower Study will require a large expansion of training offerings, of wide variety, in the Industrial Education Centers. Chapter VI discusses the programs which will be needed.

CHAPTER V

PRESENT TRAINING PROGRAMS FOR SKILLED AND TECHNICAL OCCUPATIONS OUTSIDE THE INDUSTRIAL EDUCATION CENTERS

SOURCES OF NEW WORKERS

The needs for new workers in North Carolina industries are met in part by other agencies. Since the planning of programs of instruction in the Centers is based upon state-wide manpower needs, consideration must be given to the part played by those agencies outside the Centers in filling the needs. These sources of new workers include the following:

(a) Workers who upgrade themselves to new types of skilled and technical jobs through training within industry, in the form of organized plant training programs, organized on-the-job training, and informal upgrading.

(b) Trained textile workers coming from the instruction offered at the North Carolina Vocational Textile School at Belmont.

(c) Engineering technician graduates of Gaston Technical Institute who take jobs in North Carolina.

(d) Engineering graduates from North Carolina State College and Duke University who take initial jobs as technicians, and drop-outs from these institutions who enter such jobs.

(e) Graduates of technical and vocational industrial curriculums in public and private junior/community colleges in the State.

(f) Graduates of skilled crafts programs in the high schools, and in private vocational schools.

TRAINING OUTSIDE THE CENTERS

The Manpower Study made by the Employment Security Commission provides data on the numbers of workers which the industries expect to train for themselves through in-plant training programs. Many of these industries provide this training because there is no adequate source of supply of trained workers. Experience in other states has shown that when institutions of the Industrial Education Center type become well established, the industries will increasingly turn to them for trained workers. In this study, an arbitrary estimate has been made that when the Centers get into full operation some twenty per cent of the workers which the industries now propose to train in their own plants will be recruited from graduates of the Centers. The net training needs shown in the Manpower Study to be met by the Centers have been increased by twenty per cent of the numbers expected to be supplied through in-plant training, as shown in the Manpower Study, to show the totals to be supplied. These totals, however, include the workers who will be furnished through training programs outside the Centers, and the number of workers trained in these outside institutions will need to be subtracted from the totals to determine the numbers which the Centers may be expected to supply.

Time did not permit gathering extensive data on all these agencies, but information was secured on those which appeared to have important roles in meeting the needs.

Technical Occupations

Data were obtained from North Carolina State College concerning engineering enrollments, by departments, for recent years, the numbers entering employment upon graduation, and the proportion of the total who take jobs within the State. Drop-outs, by curriculums, were estimated from successive class enrollment data, taking into account students transferring into these curriculums. It was estimated that some thirty per cent of these drop-outs take technician jobs within the State. Estimates of the numbers of engineering graduates who take technician jobs in North Carolina were arrived at by taking twenty per cent of the thirty-four per cent of the total graduating class. (About thirty-four per cent of the graduates take jobs within the State.) The percentages of the drop-outs (30%) and of the graduates (20%) who take technician jobs are rough estimates, but it is believed that they are sufficiently accurate for the purposes for which they are utilized here. Data for engineering students at Duke University who enter technician jobs were calculated by the same procedure as was used for North Carolina State College, based upon the number of graduates.

Estimates of the numbers of graduates from technician training programs at Gaston Technical Institute and Charlotte College who take jobs in North Carolina were made from data on recent enrollments and graduating classes.

Shown in Table 11 are the estimated numbers of persons entering technician jobs annually in the State from these institutions, listed by curriculums. Although these estimates are not based upon actual count of persons entering technician jobs, it is believed that they are sufficiently accurate for estimating the output needed from the Industrial Education Centers in relation to the total needs of the State for trained technicians.

TABLE 11. Estimated Numbers Trained In North Carolina Institutions Entering Technician Jobs In the State, Annually, By Curriculums

Curriculum	North Carolina State College	Duke Univ.	Gaston Tech. Inst.	Charlotte College	Total
Chemical Technology	4	—	—	1	5
Civil Technology— Building Construction	2	—	—	—	2
Civil Technology— Highway & Heavy Construction	11	2	10	3	26
Electrical/Electronics Technology	29	7	19	7	62
Mechanical Technology	26	4	10	3	43
Production Technology	3	—	—	—	3
Total	75	13	39	14	141

Skilled Crafts and Skilled Specialty Occupations

No data were available concerning the numbers of persons entering into the skilled crafts and skilled specialty occupations in the State after completion of training programs offered within the high schools. The total numbers needed in the State annually for these types of occupations, as shown in the Manpower Study, are very great, and it is quite probably that the numbers furnished presently by the high school programs fill a small portion of the total vacancies. For programs where the numbers needed are relatively small, it will be desirable that study be made of the output of the high school programs.

In the field of cosmetology, the total number of additional licenses issued annually is more than eight hundred, and the persons receiving them are scattered widely throughout the State. A prescribed training program, followed by approved work experience, must be completed before the license is issued. At present the training offered in public institutions is very limited, yet there are some fifty private schools which provide such training.

FURTHER STUDY NEEDED

Before new programs are projected in the Centers in occupational fields not provided for at present, data will need to be secured on the needs for new workers and also on the facilities outside the Centers which now provide such training. In the medical field, training is now provided for certain types of technician occupations by some of the private junior colleges of the State and a number of the hospitals.

Present programs of education of various types beyond the high school, including data on enrollments, are described in the publication, "Status of Education Beyond High School in North Carolina of Less than Four-Year Degree in Length," issued by the Department of Curriculum Study and Research, State Board of Education, Raleigh, dated January, 1962.

CHAPTER VI

TRAINING PROGRAMS REQUIRED IN THE CENTERS TO MEET THE NEEDS

Previous chapters of this report show the numbers of new workers needed by North Carolina industry in the years immediately ahead, and the numbers of these new workers which are expected to be supplied through training programs in agencies outside the Industrial Education Centers. This chapter deals with the training needs which should be met by the Centers, and the scope and size of the programs required.

ESTIMATING THE NUMBERS TO BE TRAINED IN THE CENTERS

In estimating the numbers of persons to be trained in the Centers, the following items were considered:

(a) The numbers needed as shown in the Manpower Study.
(b) Estimates of numbers needed by establishments not covered in the Manpower Study.
(c) Numbers needed by new industries entering the State.
(d) Numbers shown in the Manpower Study to be provided through in-plant training which will probably be recruited from the Centers once they are well established.
(e) Graduates of training programs in the Centers who will take jobs outside the State.
(f) Numbers of trained persons who will enter jobs in North Carolina from outside the State.
(g) Numbers of persons who will be trained in other North Carolina institutions and find jobs within the State.

The numbers needed as shown in the findings of the Manpower Study and supplementary surveys are discussed in Chapter IV. The numbers needed by new industries entering the State will have important bearing on the program of the Centers in the years ahead, but it is difficult to predict the types of industries which will be established. Frequently, a new industry which is a branch of an established industry in another State will bring with it key personnel of technician type, to help get the plant established quickly. Workers for the skilled craft and skilled specialty occupations in the plant usually are sought in the local labor market, and the Centers will face immediate training tasks following the establishment of such plants which need these types of workers. Ultimately, they will also be confronted with providing training for workers of technician type, with perhaps heavy demands for extension programs to round out the training of employed workers. Many of the industries entering North Carolina manufacture products of technical nature, requiring high degrees of precision and high levels of quality control. These industries use technical workers on all levels, from the engineering technician to the tester of specific items whose technical skills may be developed rather quickly through intensive, specific training.

In summarizing the data on training needs, no definite estimates have been made for the new industries entering the State. It has been assumed that if the Centers gear their programs to meet the projected needs shown in the Manpower Study, they will be able to meet the needs for the new industries by expansion of numbers of students in programs currently planned, and by small additions to the programs to meet specialized needs.

The Manpower Study provided data on the in-plant training which the industries expected to provide, for each occupation. Experience with technician training in other States indicates that once the Centers are firmly established, industries will turn to them for a part of the workers they had planned to train in their plants. In calculating the numbers to be trained in the Centers, it was estimated that some 20 per cent of these might ultimately come from the Centers, and these numbers have been added to the training needs to be met by the Centers as shown in the Manpower Study findings.

THE OVER-ALL PROGRAMS FOR THE CENTERS

The over-all program of an Industrial Education Center includes three types of programs:

(a) Pre-employment training for technician and skilled crafts occupations.

(b) Pre-employment training programs of short length for technical specialists and skilled specialists.

(c) Extension courses for employed workers.

The pre-employment training for technicians and for the highly skilled craftsmen, offered for high school graduates, mature high school dropouts, and adults, on a level beyond high school, may well follow a curriculum pattern which provides for two years of full-time study or the equivalent. Most of these students will ultimately be found in full-time day programs. Some will enroll on a half-time basis, attending approximately 15 clock hours per week in the day or evening. Others may wish to enroll in these curriculums and spread the work out over many years, attending fewer than 15 hours per week.

Pre-employment programs of short length, for technical specialists and skilled specialists, usually less than one year of full time study, take the form of intensive training in a narrow range of content, and may be offered day or evening.

Extension courses for employed workers will include a great variety of instruction, usually offered as short unit courses during the evening. For shift workers, they may be scheduled at other appropriate hours.

Basic planning for an over-all program for an institution providing technical and trade training is usually done by outlining the full-time pre-employment curriculums and designing the plant and equipment to meet these needs. Consideration is also given to special needs for evening and other part-time students, but usually it is practicable to fit this program into the facilities provided for the day school. This practice has been followed by the Curriculum Study staff in making the suggested program allocations shown in Chapter VII.

TRAINING PROGRAM FOR TECHNICIANS

Technicians are in such great demand throughout the nation that recruiting takes place far beyond the confines of the state in which the employer's plants are located. The placement market for well-trained graduates is very wide. Consequently, in planning how industrial needs are to be met and how many trained workers the Centers may be able to furnish, it is necessary to consider this in-migration and out-migration of trained technicians. This is especially true with the higher levels of technicians such as those of engineering-technician type. If the programs for training engineering technicians develop within the Centers more rapidly than takes place in training institutions in adjoining states, which is probable because of the rapid establishment of the Centers, it may well be that out-migration of graduates will more than offset in-migration of workers. In the planning of the numbers to be trained in the Centers, however, it has been assumed that in-migration and out-migration will be approximately equal, and no additional numbers to be trained in the Centers have been added to provide for the out-migration of graduates.

Numbers estimated to enter the labor force of technicians from institutions in North Carolina outside the Centers are discussed in Chapter V.

For the purpose of planning training programs for the higher levels of technician occupations, it is desirable that these occupations be grouped into appropriate clusters of closely related occupations which have many common elements. The nature of these clusters, and their use in curriculum development, is discussed in some detail in "Technician Programs Beyond the High School," listed in the bibliography of this report.

Technician Curriculum Titles

The different technical occupations listed in the Manpower Study findings were grouped into clusters, and curriculum titles were proposed for providing the needed training for each of these clusters. These curriculum titles are as follows:

Automotive/diesel technology
Chemical technology
Civil technology—building construction option

Civil technology—highway and heavy construction option
Commercial illustration and advertising design
Data processing technology
Electrical technology
Electronics technology
Instrumentation technology
Mechanical technology—with options in air conditioning, mechanical design, metal products manufacturing, tool design, and welding
Production technology—with options in food processing, apparel manufacture, textile manufacture, furniture manufacture, metal products manufacture, electric products manufacture, and printing
Technical writing

Other proposed curriculum titles include:

Dental assistant technology
Dental laboratory technology
Technical secretarial technology
Agricultural technology—with options

The technical occupations listed in the Manpower Study were grouped into clusters, and curriculum titles proposed for the needed training programs. Other curriculums for fields not covered in the study were added. The proposed curriculums with numbers of graduates annually from each for the state-wide program are shown in Table 12. The table includes only those curriculums for the higher levels of technician training, requiring two years of full-time training beyond the high school, or the equivalent in part-time instruction. It does not include short, intensive training programs for technical specialists, or extension programs for upgrading and updating workers now employed in technician jobs.

Descriptions of Technician Curriculums

Brief descriptions of the curriculums shown in Table 12 follow:

Automotive/Diesel Technology

The Manpower Study found no technicians in this category. But the study did not include the field of automobile maintenance, the sales field, and some other fields where such technicians might be found. Service managers of large automotive repair establishments, manufacturers' representatives concerned with the sale and service of automotive and diesel equipment, supervisors of truck fleet operation and maintenance, and similar occupations may well be considered as belonging to the technician category. The numbers are not large, but are sufficiently important to warrant the establishment of one or more training programs.

Chemical Technology

The Manpower Study covered most of the industrial chemical field, but did not include such jobs as chemicals sales, manufacturer service representatives, and workers in biological-chemical laboratories such as those associated with hospitals. A high proportion of the workers listed were chemist assistants, defined as workers whose jobs required reasonably extensive training. A few jobs included in this group consisted of testers who need training in chemistry much more limited than that needed for chemist assistants.

Civil Technology—Building Construction Option

The occupational needs allocated to this curriculum include a portion of the numbers listed in the Manpower Study as civil and construction technicians, estimators, and structural draftsmen, with the remaining needs in these categories allocated to the curriculum option in highway and heavy construction. Included also are building inspectors and fixture designers. Numbers needed as architectural draftsmen were not shown in the study.

Present programs in the Centers include some curriculums carrying the broad title of drafting and design technology, which provide basic training in drafting techniques together with instruction in architectural drafting, mechanical drafting, and other drafting. Some of the jobs open in the various fields of drafting require fairly limited breadth of instruction, which can be provided as separate programs. It is believed by the Curriculum Study staff that it would generally be preferable to include the specialized drafting as integral portions of broader curriculums in the fields for which the drafting is needed. Thus architectural and structural drafting would be included in the building construction option of the civil technology curriculum; mechanical

TABLE 12. Proposed State-Wide Technician Training Programs, Including Estimated Numbers to be Training Annually, By Curriculums

Curriculum	Total Needed Annually	Numbers Trained Outside The Centers	Numbers To Be Trained In Centers
Automotive/diesel technology	(no data)	—	—
Chemical technology	181	5	176
Civil technology—building construction	163	12	151
Civil technology—highway & heavy construction	188	16	172
Commercial illustration & advertising design	39	—	39
Data processing technology	220	—	220
Dental assistant technology	(no data)	—	—
Dental laboratory technology	(no data)	—	—
Electrical technology	97	22	75
Electronics technology	102	40	62
Instrumentation technology	(no data)	—	—
Mechanical technology—options in air conditioning, mechanical design, metal products manufacturing, tool design and welding	161	43	118
Production technology	319	3	316
Production tech.—Apparel manufacture			(28)
Production tech.—Electric products mfr.			(47)
Production tech.—Food processing			(35)
Production tech.—Furniture manufacture			(26)
Production tech.—Metal products mfr.			(52)
Production tech.—Printing			(11)
Production tech.—Textile manufacture			(78)
Production tech.—Miscellaneous			(39)
Technical secretarial technology	(no data)	—	—
Technical writing	19	—	19
Agricultural technology	(no data)	—	—

drafting would be a part of mechanical technology; and topographical drafting would be a part of the curriculum in civil technology—highway and heavy construction.

Civil Technology—Highway and Heavy Construction Option

The occupational needs allocated to this curriculum include a portion of the civil and construction technicians, estimators and structural draftsmen shown in the Manpower Study, together with study data on instrument man (surveyor). Relatively large numbers of highway engineering aides are employed by the State Highway Department, not covered in the study, and these have been added to the numbers needed.

This field offers opportunity for specialized training in portions of the total job of the highway and heavy construction technician, such as structural drafting and surveying.

Commercial Illustration and Advertising Design

The Manpower Study data for this field list the workers as commercial artists, an occupational title which might be interpreted by some persons as dealing with a narrow range of poster design and the like. The occupational description used for this title encompassed a rather wide range of duties, many of which implied the need for a fairly broad scope of training of reasonably high level. The study did not cover all of the types of establishments which need such workers, and it seems probable that the placement market for trained workers of technician level in this field will justify the establishment of appropriate training programs in Centers which also provide instruction in the printing field. The physical facilities required for such a curriculum are somewhat different from those needed for drafting.

Data Processing Technology

The field of data processing is developing so rapidly that it is difficult to predict needs. The information reported in the Manpower Study covered only a small proportion of the workers employed in this field, since the coverage omitted State government, banks, insurance companies, and other users of computers. The numbers shown in the study included only the more complicated jobs such as programmer, project planner, and systems analyst. Estimates of needs for workers of these types were obtained from a computer manufacturer's representative which indicate relatively large expansion in the years immediately ahead. The numbers shown in Table 14 for this curriculum are believed to be conservative, and only a moderate expansion of training facilities is recommended at this time. Data processing is a field which needs to be watched. Some nation-wide estimates of needs indicate numbers far beyond present facilities for training. Some Centers may well provide training for the basic operations of data processing even though they may not be able to offer a program requiring the use of a computer.

Dental Assistant Technology

Dental Laboratory Technology

These fields were outside the scope of the Manpower Study, and no data were gathered by the Curriculum Study staff concerning the needs. Previous local surveys have shown placement opportunities, and some training in these fields is now under way. No expansion of facilities is recommended at this time beyond that which is currently being planned.

Electrical Technology

The Manpower Study data included information on needs for electrical draftsmen, electric power technicians, and electrical specification writers. Although no additional data were gathered, it is quite probable that many additional persons are needed annually in such fields as electrical maintenance, sale of specialized electrical equipment, and the like. Study of training programs for this field outside the Centers indicates that quite a few electrical technicians will be supplied from this source. The skilled craft occupation of electrical installation and maintenance includes a considerable amount of technology, and the training program in electrical technology may well utilize some of the same facilities as are needed for the skilled craft training. Also, the electrical technology curriculum usually provides work in the first year which is identical with that of the electronics technology curriculum. Thus they both may well be offered in the same Centers.

Electronics Technology

The Manpower Study listed electronics technicians and radio/TV transmitting technicians. Not included in the study were such occupations as sales of electronic equipment, airport control technicians, and others. It is probable that a considerable number of electronics technicians will be needed beyond those indicated by the study. Other institutions outside the Centers will probably furnish trained electronics technicians in reasonably high numbers. Electronics curriculums may well be offered in Centers which also offer electrical technology, and radio/TV repair, usually classified as a technical specialty as contrasted with the broader occupation of the electronics technician.

Instrumentation Technology

Manpower Study data did not isolate jobs in the instrumentation field; they probably have been included among the mechanical and electrical technicians. With the rapid growth of automation has come the increasing need for instrumentation technicians who are familiar with many types of pressure, temperature, flow, electrical and electronic instruments and their application to process control. The field cuts across mechanical and electrical/electronics technology but is sufficiently distinctive to warrant separate training programs, especially where local studies indicate strong needs for extension courses.

Mechanical Technology

The broad field of mechanical technology cuts across several groups of technician occupations which deal with the design, development, testing, manufacture, installation and maintenance of various types of machines and metal products. The Manpower Study shows need for technicians in such mechanical fields as air conditioning, machine design, tool design, welding, and metal products manufacturing. Each of these specific fields has its own specialized content, as well as the basic content common with other mechanical fields.

Curriculum planning frequently takes the form of basic mechanical technology instruction followed by specialization in a selected field, the specialized instruction usually being offered in the second year of the two-year curriculum. This will permit offering only the first year of this program in some Centers, with students transferring to other Centers which offer the full curriculum at the end of their first year of study.

Study data shown for air conditioning/refrigeration technicians did not include employment in the fields of consumer service, wholesale and retail sales, manufacturers' representatives, and the like, which provide some jobs for technicians. It is probable that a reasonable number of persons will be needed annually in addition to those noted in the study.

In the field of mechanical design, the technician needs thorough training in the techniques of drafting and design, but he also needs extensive background information and understandings with respect to materials of industry, strength of materials, production methods in metal working, basic aspects of metallurgy, and other related technology. A satisfactory training program for such a technician will usually require the two-year full-time program in mechanical technology. Many jobs for mechanical draftsmen are available, some of which do not require the extensive background. The over-all program of the Centers may well provide some such training, with the hope that the students completing these programs will return to evening courses to round out their training through courses in the related technology.

The field of metal products manufacturing has many jobs of the mechanical technician type which require understanding of production machines and their functions, tooling requirements, inspection practices, assembly procedures, etc., from a technical standpoint. The student preparing for this field would get the basic instruction in mechanical technology during the first year, and follow this during the second year with the special subjects noted above.

The tool design technician needs skills in basic drafting and design plus specialized instruction in the construction, functions, and design of cutting tools, jigs, fixtures, and dies. He must also have thorough understanding of the many types of metalworking production machines, and of toolroom practices in the making of cutting tools, jigs, fixtures, and the like. Persons entering a training program in tool design should preferably have had previous experience in toolmaking.

The study showed a few potential jobs for welding technicians. The curriculum for providing such training may well follow the basic pattern for mechanical technology during the first year, followed by specialized courses in welding and its allied technology during the second year. This field may be a growing one due to the many new alloys developed in recent years, and the special requirements faced when welding these alloys.

Production Technology

This is a field for technician training largely overlooked in previous planning for training programs in the Industrial Education Centers, but one which appears to be of great importance to the industries of North Carolina. The Manpower Study shows relatively high needs in such occupations as cost technicians, estimators, industrial technicians, production planners, quality control technicians, and time study men. These jobs involve both technology and management techniques, and cut across all types of manufacturing industries.

Curriculums for production technology might well take the form of basic instruction in the fundamentals which are common to all industries during the first year of instruction, followed by specialization in various industrial fields during the second year. Suggested specializations include apparel manufacture, electric products manufacture, food processing, furniture manufacture, metal products manufacture, printing, and textile manufacture.

Persons who have had previous experience in specific industrial fields for which programs of instruction are offered will have distinct advantage over those without such experience. The present pattern of scheduling pre-employment training so that employed workers may attend fifteen hours per week appears to be well suited to this field.

Technical Secretarial Technology

The tasks of this occupation are related to engineering services and data processing. No information was gathered in the Manpower Study concerning needs in this field, but local studies indicate sufficient opportunities for placements to warrant the establishment of this curriculum in a limited number of Centers which will also offer data processing technology.

Technical Writing

The Manpower Study showed need for 19 persons annually as writers of copy for technical publications such as service manuals. This type of writing requires a person who is able to assemble technical data and present them in organized, readable form. The jobs are found in many types of industries, and each requires the writer to understand the technology of the specific occupational field for which the writing is done. A curriculum for training technical writers must thus include both technology and writing technique. Adequate understanding of the technology needed requires an extended period of training. It is suggested that technical writing training be provided as a supplement to the technological curriculums in fields such as mechanical or electrical/electronics technology where placement opportunities will most frequently be found.

Other Fields for Suggested Study

In addition to the types of programs described above, which are proposed for immediate attention in the Centers, there are several other fields of technology in industry, business, and agriculture toward which attention should be directed when it is practicable to expand the offerings of the Centers beyond the present proposals. Among these are the following:

Aviation maintenance technology
Metallurgical technology
Technical photography
Technical sales technology
Medical laboratory technology
Medical office assistance
Dietetic aides for hospitals and nursing homes
Accounting technology
Banking, real estate, and insurance technology
Retail merchandising technology
Secretarial technology, with options in special fields
Food service administration
Hotel/motel technology
Institutional management technology (homes for the aged, etc.)
Interior decoration technology
Nuclear technology

Training programs for all of these fields are found in technician training institutions in other states. Each field would need survey of present and potential employment opportunities, and the extent to which they are now being met by other agencies in the State, before programs are planned for the Centers. Special attention is called to possible needed expansion of offerings in food processing technology in keeping with the effort presently being put forth to develop more industries of this type in the State. In some sections of the country, the field of nuclear technology is expanding rapidly, and this may bear watching.

Agricultural Technology

Training programs on the technician level, similar to those in the fields of industry, are needed to prepare persons effectively for many types of jobs in the field of agriculture and in fields closely related thereto. In other sections of the country, New York State, for example, successful two-year pre-employment programs have been offered in such fields as the following:

Agricultural business
Agronomy and soil conservation
Animal husbandry
Dairy industry
General agriculture
Poultry husbandry
Farm machinery sales and service
Flower shop management
Greenhouse management
Nursery-landscape management, etc.

Some of these programs require extensive investment in land, farm buildings, livestock, and the like. Others can be handled successfully in a setting of an Industrial Education Center.

It would appear feasible for Centers located in predominantly agricultural areas to offer training programs in farm machinery sales and service, and possibly in such fields as agricultural business enterprises or floriculture.

Farm machinery sales and service ties in well with other programs commonly found in Industrial Education Centers, such as automotive repair and welding, and may well be offered in Centers where surveys show adequate needs. Such a survey has already been made in the Goldsboro-Wilson area, and the needs appear to warrant such a program offering.

Farm machinery sales and service requires a considerable number of workers on the skilled trades level for the repair and maintenance of farm equipment, involving such skills as gasoline and diesel maintenance, welding, basic hand and machine tool skills, and the like. The numbers needed for this level of work are far greater than those needed for the management and supervision of such enterprises. Training for the "technician" type of job in farm machinery sales and service usually includes much of the content found in the program for the skilled mechanics but goes beyond this to include the business management aspects. Both types of programs may well be offered in the same Center, if the needs for both programs are sufficient.

The term "Agricultural Business Enterprises" as used here includes business establishments designed to serve needs in such fields as feed mill operation, grain handling, milk handling, sales of fertilizers and insecticides, etc. The training program would involve some technical aspects and considerable business management. The school plant and equipment needs perhaps would not be very great beyond the classroom and laboratory facilities commonly found in the Centers. It would appear to be practicable for such training to be offered in Centers where occupational surveys reveal needs, and where detailed study of the curriculum content required would indicate the feasibility of providing the plant and equipment needed for such training.

In those fields of agriculture technology which require extensive investment in land, farm buildings, livestock, and the like, it does not seem practicable or desirable to provide training programs in the Industrial Education Centers. The Agricultural Institute Division of North Carolina State College has recently established several such programs, with abundant facilities. Expansion of this type of training may well take the form of extension of the State College programs, or the establishment of suitably located agricultural institutes specially designed to meet the needs. Further study is needed.

Number of Technician Training Programs Needed

Steps were taken to determine the number of programs needed for each occupational field in the State as a whole. The Curriculum Study staff met with the State Director of Vocational Education, the Coordinator of the Industrial Education Centers, the Assistant Coordinators, the State Supervisor of Trade and Industrial Education, and the Coordinator of the Instructional Materials Laboratory to discuss the findings of the Manpower Study and to make tentative decisions concerning the types and numbers of programs needed. The needs for each type of training were discussed by the group, the present and potential facilities of the Centers were taken into consideration, as well as the limits to which the programs should develop at the present time. Out of this discussion, Table 13 was developed. This Table lists the proposed technology program titles together with the suggested total number of programs to be offered. Some of these would take the form of small programs, with minimum permissible enrollments. (This was construed to be a curriculum with 20 students the first year, and at least 12 students the second year.) Other programs which involve heavy expenditures for equipment were expected to enroll higher numbers of students. These programs were later apportioned among the various Centers, as discussed in Chapter VII.

TABLE 13. Suggested Numbers of Technician Training Programs Needed In the Industrial Education Centers, By Curriculums

Curriculum	Number of full two-year programs	Number of first-year programs[a]
Chemical Technology	3	0
Civil Technology—Building Construction	9	1
Civil Technology—Highway and Heavy Construction	11	0
Commercial Illustration and Advertising Design	3	0
Data Processing Technology	4	0
Electrical Technology	5	4
Electronics Technology	6	4
Mechanical Technology	4	1
Production Technology:		
Apparel Manufacturing	2	0
Electrical Products Manufacturing	3	0
Food Processing	3	0
Furniture Manufacturing	2	0
Metal Products Manufacturing	3	0
Printing	1	0
Textile Manufacturing	4	0
Technical Writing	1	0

[a] The first year of a two-year program, with students transferring to a Center with a full program at the end of the first year.

TRAINING PROGRAMS FOR THE SKILLED OCCUPATIONS

The task faced by the Industrial Education Centers in meeting the needs of the State for workers in the skilled occupations is a much larger task, from the standpoint of numbers needed, than that for the training of workers for technical occupations. Data from the Manpower Study show needs approximately three times as great. Several occupational fields with heavy employment in the skilled occupations were without the scope of the Manpower Study. The Curriculum Study staff was able to secure estimates of numbers required in a few of the fields not covered in the study.

Estimates were made of the numbers of workers to be trained through in-plant training programs, as shown in the Manpower Study, that may be recruited from the Centers once they are in full operation. These estimated numbers were added to the data on workers needed as shown in the study, in the same manner as was done for technical workers and noted earlier in this chapter.

Discussion of Each Occupation

Data from the Manpower Study concerning the skilled occupations for which workers will be needed were supplemented by data from other sources to make up the list of occupations shown in Table 14, for which the Centers should provide training programs. Brief discussion of each of these occupations follows:

Air Conditioning/Refrigeration Mechanics

The Manpower Study did not cover wholesale and retail sales, and consumer service in this field, and certain other establishments where skilled craftsmen are employed. It was roughly estimated that 90 new workers will be needed annually in addition to the 98 shown in the study.

Auto Mechanics

No data were obtained in the study for this field. Training programs sometimes take the form of specialization within the field such as auto body repair and automotive machine shop practice. It was not practicable to estimate the numbers needed in these specialties, so the needs have been grouped under the single heading of auto mechanics. The numbers needed were obtained from automotive vehicle registrations estimated for 1966 at 2,022,000 vehicles, with an estimated number of automotive mechanics needed on the basis of 87 vehicles per mechanic,* and an annual replacement of five per cent. This indicated need for 1165 new workers annually by 1966, from which were subtracted the 255 diesel/truck mechanics shown in a later section of this report.

Bricklaying

No data were available concerning needs in this field. In the light of the large numbers employed in the construction field as a whole, and the numbers needed for carpentry, for example, as shown in the Manpower Study, it is probable that training should be provided for substantial numbers. Additional survey data should be obtained for this occupation. A relatively large number of training programs in this field are now in operation in the high schools of the State, and these should be taken into consideration when planning programs in the Centers.

Cabinetmaking (furniture)

Data on needs in this occupation as reported in the Manpower Study showed 159 new workers required annually. It is probable that considerable numbers are needed in other industries not canvassed for this occupation in the study.

Carpentry

The study showed need for 751 new workers annually. Since relatively few training programs are now provided in the high schools and the Centers, this field may well receive considerable attention.

Cosmetology

Data from the North Carolina State Board of Cosmetic Arts show that 9,488 licenses for cosmetologists were issued in the fiscal year 1956-57, and that the growth has been relatively steady at some 873 new licenses per year. Approximately fifty private schools in North Carolina provide training for this field. Little is being offered in public schools. This is a field which offers much opportunity for publicly supported training programs.

Diesel/Truck Mechanics

The study showed the need for 255 new workers annually. It is probable that a reasonable number of the new workers shown under Auto Mechanics would be included in the category of truck/diesel mechanics.

Electricians

The Manpower Study showed the annual need for 371 electricians in the industries covered by the study which included the construction field, manufacturing, and certain other establishments. Establishments mainly concerned with sales and service in the electrical field were not covered. It is probable that reasonable additional numbers will be found needed in these and other fields. Very little is now being done in providing training for this field, and the Centers may well expand their offerings greatly.

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* Ratio of mechanics to automotive vehicles in Mary C. Kohler and Andre Fontaine. "Can Our Schools Bridge The Gap?", *Saturday Evening Post*, March 17, 1962

Electroplating

The Manpower Study showed the need for 33 new workers annually. One training program might well be established.

Furniture Finishing

Although this occupation does not require a long training program, it is included here since it may be desirable to provide such training as a part of a broader offering in the field of furniture manufacture. The Manpower Study showed need for 145 new workers annually.

Machine Shop Practice

The Manpower Study showed annual need for 413 machinists. As this program is basic to toolmaking, and a course in machine shop practice is usually provided for curriculums in mechanical technology and some of the other technician training programs, as well as for certain curriculums in the skilled training fields, it may well be offered in all of the Centers.

Plumbing and Steamfitting

The study indicated need for 254 annually in this field. This is one of the skilled crafts for which it is difficult to provide training for competency within the walls of a school. Perhaps the best way of providing the training needed is to set up programs of basic instruction within the Centers and to follow this with on-the-job training through apprenticeship or other arrangement. Little instruction is now being provided in this field, and some attention may well be given to it.

Power Machine Sewing

No data were gathered on numbers needed for this occupation. The apparel manufacturing industry in North Carolina is growing at a very rapid rate, with many new establishments entering the State. In 1960, some 35,000 workers were employed in this industry, and the estimated growth by 1966 is nearly fifty per cent. The numbers of power machine operators needed are great. In the past, this need has been partially met in the Centers by short, intensive courses of temporary character, set up to provide workers for specific industries. This may well be continued, perhaps supplemented by some programs of more permanent nature designed to prepare workers for a number of different establishments rather than for a single employer.

Practical Nursing

No data on this field were obtained in the Manpower Study. Information from the State licensing board indicates an average growth per year of 370 practical nurses. Reasonably adequate facilities are now provided in the Centers and elsewhere to take care of the needs.

Printing

Manpower Study data indicate annual needs for 173 printers, offset pressmen and photolithographers. Training for competency in the printing field requires programs with somewhat extensive equipment for both letterpress and offset printing. It is recommended that training for this field be provided through a limited number of large programs with well-equipped shops, in contrast to a larger number of small programs.

Radio/Television Repair

The Manpower Study did not cover this occupation, although the data on electricians may have included some workers in this category. Large numbers are employed in service establishments, sales organizations, and the like, and the field is apparently growing. The need is sufficiently great to warrant consideration of establishing training in this field in each of the Centers. Some of the Centers which have been offering a limited amount of training for electronics technicians may well direct their effort to specialization in radio/television repair.

Sewing Machine Repair

The study indicated need for 80 new workers annually. This is a skilled specialty occupation for which adequate training can be provided in a relatively short time with a minimum outlay for equipment. It is suggested that mobile equipment be provided, which can be moved from Center to Center and utilized as needed to meet local demands for workers.

Sheet Metal Work

Manpower Study data revealed needs for 353 new workers annually. This field may well receive increased attention, especially in Centers which also provide training in air conditioning and refrigeration mechanics training.

Textile Machinery Repair

Inquiry was made in the Manpower Study as to needs in knitting machine fixing, loom fixing, and spinning frame fixing. Relatively large numbers of new workers were expected to be needed for each of these occupations, but the employers planned to provide most of them through in-plant training. As employers see the feasibility of having the training done in the Centers, with co-operation of the employers in furnishing necessary machines and supplies, it is probable that a considerable amount of such training should be provided there. Such programs should grow out of local needs.

Tool-and-Die Making

The study showed needs for 71 new workers annually. Although the numbers involved are not large, in comparison with some of the other skilled crafts, these workers are of critical importance to many industries, and effort should be made to meet the needs.

Upholstery

Manpower Study data on the furniture industry indicate need for 320 workers annually. The training needed can be provided through relatively short programs. Some such programs are now being offered in the Centers, and these may be able to provide the workers needed.

Welding

The Manpower Study data showed need for 246 new welders annually in the industries covered. It is probable that many additional workers will be needed in service and other establishments not studied in the study. This type of training also fits into other programs as an auxiliary course.

Number Programs Needed

The steps taken to determine the number of programs needed for each of the skilled crafts and skilled specialties in the State, as a whole, follow the procedure used for determining the technician training programs needed, as outlined earlier in this Chapter. Out of this discussion Table 14 was developed, showing the curriculum offerings suggested for the immediate future together with the number of programs needed for each field.

TABLE 14. Suggested Numbers of Skilled Occupations Training Programs Needed In the Industrial Education Centers, By Curriculums

Curriculum	Number of Programs	Possible Additional Programs
Air Conditioning/Refrigeration Mechanics	10	3
Auto Mechanics	20	
Cabinetmaking	3	
Carpentry	6	
Cosmetology	As needed, beyond present programs	
Diesel/Truck Mechanics	5	5
Electrical Installation and Maintenance	20	
Electroplating	1	
Furniture Finishing	3	
Machine Shop Practice	20	
Plumbing and Steamfitting	4	
Power Machine Sewing	As needed locally	
Practical Nursing	As needed, beyond present programs	
Printing	2	1
Radio/Television Repair	20	
Sewing Machine Repair	As needed locally	
Sheetmetal Work	8	4
Textile Machinery Repair	As needed locally	
Tool-and-Die Making	5	
Upholstery	3	
Welding	7	3

Suggested allocation of programs by Centers is discussed in Chapter VII.

Other Skilled Occupations for Which Training Programs May Be Desirable

Other fields of training for skilled occupations beyond those outlined in Table 14 are worthy of consideration. Here are some of them:

Automatic Vending Machine Maintenance

This is a growing occupation, which cuts across mechanical and electrical skills.

Baking

Manpower Study data show needs for some 25 new workers annually. Many others will probably be needed in small establishments not covered in the study.

Commercial Cooking

Large numbers are employed in this field, and it may well be investigated for potential training programs.

Instrument Repair

With rapid increase in automation, with equipment controlled by instruments of various types, this field may well be investigated.

Laundry and Dry Cleaning

Large numbers are employed in this field. It may warrant investigation.

Office Machine Repair

The repair of the simpler types of office machines—such as typewriters, adding machines, and the like—may offer training possibilities.

Small Gasoline Engine Repair

The repair of power mowers, outboard motors, and other equipment powered by small gasoline engines may offer training possibilities.

CHAPTER VII

SUGGESTED ALLOCATION OF PROGRAMS TO THE INDUSTRIAL EDUCATION CENTERS

In Chapter VI, the needs for new workers in the various skilled and technical occupations were analyzed, and the numbers of programs required to meet these were indicated. The present chapter deals with the allocation of these programs to individual Centers.

FACTORS CONSIDERED IN MAKING ALLOCATIONS

In arriving at program allocations, the following items were considered.

a. The geographical spread of employment opportunities, by areas, as found in the Manpower Study.
b. Programs already in operation at the Centers or in an advanced planning stage.
c. Programs with needs sufficiently large to justify offerings in each Center.
d. Programs with limited needs which justify offerings in only one Center or in a limited number of Centers.
e. Inter-relationships of programs within Centers.
f. Two-year programs for which the first year of work might be offered in certain Centers.
g. The location of the Center in relation to employment opportunity in the area.
h. Potential living accommodations for students who must reside away from their homes to obtain the specific training they desire.

Information concerning programs in operation at the Centers is found in Chapter I.

Data on the geographical spread of employment opportunities, by areas, as found in the Manpower Study are shown in Table 15 for technical occupations and in Table 16 for skilled occupations. Information was compiled in the Manpower Study on employment needs by specific occupations. For the technician occupations, several of the occupations were usually grouped into clusters to form the basis for curriculum development. In preparing Table 15, the employment needs for each technician occupation, by areas, were combined to form the totals for the various curriculums. Figure 2 in Chapter IV shows a map of the

TABLE 15. Estimated Numbers of Technicians Needed to Be Trained Annually In the Centers, By Curriculums, By Geographical Areas

(Apportioned to areas on basis of Manpower Study Data)

Curriculum	State Total	Area I	II	III	IV	V	VI
Chemical Technology	176	49	41	38	20	13	15
Civil Technology—Building Const.	151	37	36	33	19	10	16
Civil Tech.—Highway & Heavy Const.	172	27	42	41	26	13	23
Commercial Illust. & Adv. Design	39	12	9	8	4	3	3
Data Processing Technology	220	—	—	—	—	—	—
Electrical Technology	75	16	27	6	18	5	3
Electronics Technology	62	15	15	13	8	4	7
Mechanical Tech.—Air Cond/Ref.	6	2	2	1	—	1	—
Mechanical Tech.—Mech. Design	69	23	16	14	7	4	5
Mechanical Tech.—Metal Products Mfg.	16	5	4	4	1	1	1
Mechanical Tech.—Tool Design	16	5	4	3	2	1	1
Mechanical Tech.—Welding	11	3	3	2	1	1	1
Production Technology	316	87	75	64	38	28	24
Production Tech.—Apparel Mfg.	28	7	6	6	1	3	5
Production Tech.—Textiles	78	25	15	20	9	6	3
Production Tech.—Food Processing	35	6	6	7	5	5	6
Production Tech.—Furniture Mfg.	26	13	6	5	1	1	0
Production Tech.—Metal Products	52	14	11	12	3	7	5
Production Tech.—Elec. Equip. Mfr.	47	8	19	3	13	3	1
Production Tech.—Printing	11	2	3	3	2	0	1
Production Tech.—Miscellaneous	39	12	9	8	4	3	3
Technical Writing	19	6	5	4	2	1	1

TABLE 16. Estimated Numbers to Be Trained Annually for the Skilled Crafts and Skilled Specialty Occupations, *In the Centers and Elsewhere*, By Curriculums, By Areas

Curriculum	State Total	Area I	II	III	IV	V	VI
Air Conditioning/Refrig. Mechanics	188	52	44	41	22	13	16
Auto Mechanics	910	185	135	142	119	141	188
Cabinetmaking (Furniture)	159	79	42	24	5	8	1
Carpentry	751	115	214	156	110	51	105
Cosmetology	873	177	129	136	115	135	181
Diesel/Truck Mechanics	255	36	64	66	40	18	31
Electrical Install. & Maintenance	371	72	89	86	53	25	46
Electroplating	33	11	8	7	3	2	2
Furniture Finishing	145	73	38	22	4	7	1
Machine Shop Practice	413	126	96	88	43	28	32
Plumbing & Steamfitting	254	48	61	59	37	17	32
Power Machine Sewing	—	—	—	—	—	—	—
Practical Nursing	370	72	41	47	100	49	61
Printing	171	25	44	48	26	12	16
Radio/Television Repair	—	—	—	—	—	—	—
Sewing Machine Repair	80	31	15	15	6	5	8
Sheetmetal Work	353	74	84	81	49	24	41
Textile—Knitting Machine Fixing	75	—	—	—	—	—	—
Textile—Loom Fixing	5	—	—	—	—	—	—
Textile—Spinning Frame Fixing	116	38	21	33	12	7	5
Tool and Die Making	71	23	16	15	7	5	5
Upholstery	320	159	84	49	10	15	3
Welding	246	65	58	54	29	17	23

State broken down into the areas used for compiling the data. State maps showing the concentration of industry, by counties, for chemicals, food and kindred products, furniture and fixtures, electrical machinery and equipment, printing and publishing, machinery (except electrical machinery), and fabricated metal products are found in Appendix H.

Data on student enrollment potential and demand for technical education by various areas of the State are found in Chapter VIII.

Some technician training programs have common content with other technician training curriculums and with programs on the skilled occupations level. Maximum efficiency in the utilization of staff and equipment indicate the desirability of inter-related programs being offered in the same Center if the needs are sufficient to warrant offering the different programs. Table 17 shows some of these inter-related programs. They were taken into consideration in the allocation of curriculums to specific Centers.

TABLE 17. Suggested Grouping of Technician Training Programs, Within Centers, With Other Trade and Technical Programs

Technical Curriculum	Auto Mechanics	Electrician	Bldg. Trades	Machine Shop	Tool Making	Welding	Air Cond. Mech.	Truck/Diesel Mechanics	Dental Hygiene	Dental Lab.	Data Processing	Mech. Technol.	Elect. Technol.	Electron. Tech.	Chemical Tech.	Printing	Radio/TV Repair
Automotive/Diesel Technol.	x			*		x		x				*					
Chemical Technology																	
Civil Technol.—Bldg. Constr.		*	x				*										
Civil Technol.—Heavy Constr.						*		*									
Comml. Illust. & Adv. Design																x	
Data Processing Technology														x			
Dental Hygiene Technology										*							
Dental Laboratory Technology									*								
Electrical Technology		x															
Electronics Technology																	x
Farm Power & Machy Technol.		*		*		*		*									
Instrumentation Technology				*								x	x	x	*		
Mechan. Tech-Air Cond.		*		x		*	x										
" " Mechan. Design				x		x	*										
" " Metal Pro. Mfg.		*		x	x	x											
" " Tool Design				x	x	x											
" " Welding		*		x													
Production Technology			(See Footnote a)														
Technical Sec. Technology											*	*	*				
Technical Writing			(See Footnote b)														

x Essential

* Desirable

[a] Production Technology—If desired for special fields (such as furniture or textiles) should be in same Center as other training in those fields.

[b] Technical Writing—May well be associated with a specific field, such as an option in Mechanical Technology, Electronics Technology, etc.

ALLOCATION OF PROGRAMS

Tables 18 and 19 show the allocation of program offerings to the various Centers. The allocations were made in conference sessions which included the State Director of Vocational Education, the Coordinator of the Centers and his assistants, the Coordinator of Industrial Education, and others, together with the Curriculum Study staff. The suggested allocations are tentative and some revisions will probably be needed. It is suggested that the allocations be reviewed at length with the directors of the Centers, and with others specially concerned with the programs.

ALLOCATED PROGRAMS COMPARED WITH CURRENTLY APPROVED PROGRAMS

Also shown in Tables 18 and 19, along with the suggested allocation of programs, are the programs which have been approved,* to date, for offering in the Centers. The differences that exist between the programs allocated in this study and those currently approved for the Centers are not entirely resolved in this study. The solution of this question will require additional surveys of areas which could not be covered in the Manpower Study, a consideration of making educational opportunity available to North Carolinians who will migrate for employment, and a consideration of the interests of local people.

For the curriculum areas in which programs are allocated, however, the programs allocated can be considered as a minimum need because the allocations are based upon several appropriate factors, including the geographical spread of employment opportunities. Thus, effort should be made to get approval of programs which are allocated, but which are not currently approved. The approved programs which are in excess of the allocated programs should be evaluated and continued only if they can be justified in terms of student demand, local interests, and maintaining acceptable qualitative standards.

For some curriculum areas shown in Tables 18 and 19, the extent of manpower needs were not known sufficiently to allocate programs. Yet, the need for programs is generally recognized and some programs have been approved for offering. Additional surveys, especially of the health, service, and agricultural employment opportunities are needed in planning for additional programs which may be needed.

An important function of the Centers is the offering of many different types of short courses which are needed by employed adults. It was not feasible to allocate such courses, however, because they are usually planned in the short-run and as local demand warrants.

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* List of approved programs was provided by the Coordinator, Industrial Education Centers, State Dept. of Public Instruction, Raleigh, August, 1962. At this time, programs for the Centers of Davidson, Rowan, Wake, and Pitt are in the process of development and are not shown in Tables 18 and 19.

TABLE 18. Some Suggested Program Allocations and Currently Approved Program Offerings for Technician Training In the Centers

TECHNICIAN TRAINING—Suggested Programs by Centers (Based upon assumption of 12 graduates annually per minimum program, and that 20% of total needed will come through part-time programs.)	State Total No. Workers Needed Annually	AREA I			AREA II			AREA III				AREA IV			AREA V			AREA VI			
		ASHEVILLE	CATAWBA	GASTONIA	GUILFORD	LEAKSVILLE	WINSTON-SALEM	CHARLOTTE	DAVIDSON	RANDOLPH	ROWAN	BURLINGTON	DURHAM	WAKE	FAYETTEVILLE	GOLDSBORO	SANFORD	PITT	LENOIR	WILMINGTON	WILSON
AUTOMOTIVE TECHNOLOGY	a											*	*								
CHEMICAL TECHNOLOGY	176	x*						x*				*	*						x*		
CIVIL TECHNOLOGY—Bldg. Construction	151	x	x	x	x		x	x	x					x	x			x			
CIVIL TECHNOLOGY—Hwy. & Heavy Construction	172	x	x		x		x	x		x*			x	x	x*			x		x	
COMMERCIAL ILLUSTRATION & ADVER. DESIGN	39						x	x				*		x							
DATA PROCESSING TECHNOLOGY	220	x						x*				x*		x							
DENTAL ASSISTANT TECHNOLOGY	a											*				*					
DENTAL LABORATORY TECHNOLOGY	a												*								
ELECTRICAL TECHNOLOGY	75	/	x		x		x	/				x*	x*		/						/
ELECTRONIC TECHNOLOGY	62	x*	/*	*	/*	*	x*	x*		*		x*	/*		/*	*	x*		*	*	x*
INSTRUMENTATION TECHNOLOGY	a	*																			
MECHANICAL TECHNOLOGY—Air Conditioning	6		*									*	*		*		*		*		*
MECHANICAL TECHNOLOGY—Mechanical Design	69																				
MECHANICAL TECHNOLOGY—Metal Products Mfg.	16	x*					/	x*				x*	*								x*
MECHANICAL TECHNOLOGY—Tool Design	16											*									
MECHANICAL TECHNOLOGY—Welding	11																				
PRODUCTION TECHNOLOGY—Food Processing	35	x									x					x					
PRODUCTION TECHNOLOGY—Apparel Mfg.	28										x					x					
PRODUCTION TECHNOLOGY—Textile Mfg.	78		x	x		x*						x*									
PRODUCTION TECHNOLOGY—Furniture Mfg.	26		x		x																
PRODUCTION TECHNOLOGY—Metal Products Mfg.	52			x			x					x									
PRODUCTION TECHNOLOGY—Electric Products Mfg.	47	x					x							x							
PRODUCTION TECHNOLOGY—Printing	11							x													
TECHNICAL SECRETARY	a											*							*		
TECHNICAL WRITING	19						x														
TECHNICAL OR MECHANICAL DRAFTING	a	*	*	*		*	*	*		*		*	*		*	*	*		*	*	*
TRANSPORTATION MAINTENANCE	a																				*
AGRICULTURAL TECHNOLOGY	a	*	*				*									*	*		*		*
DISTRIBUTIVE EDUCATION	a	*						*				*	*								*

Key: x—Full program allocated
/—First year of program allocated
*—Currently approved program offered or projected
a—No data on the number of workers needed; therefore, no allocations made

TABLE 19. Some Suggested Program Allocations and Currently Approved Program Offerings for Skilled Trades Training In the Centers

SKILLED TRADES TRAINING—Suggested Programs, by Centers (Based upon assumption of 2-year programs for the highly skilled crafts with 12 graduates annually per program, and 15 per one-year program.)	State Total No. Workers Needed Annually	AREA I			AREA II			AREA III				AREA IV			AREA V			AREA VI			
		ASHEVILLE	CATAWBA	GASTONIA	GUILFORD	LEAKSVILLE	WINSTON-SALEM	CHARLOTTE	DAVIDSON	RANDOLPH	ROWAN	BURLINGTON	DURHAM	WAKE	FAYETTEVILLE	GOLDSBORO	SANFORD	PITT	LENOIR	WILMINGTON	WILSON
AIR CONDITIONING/REFRIGERATION MECHANICS	188	x*	x*	x*	x*		x	x	?		x	x	?		x					x*	?
AUTO MECHANICS	910	x*	x*	x*	x*	x*	x*	x*	x	x*	x	x*	x	x	x*	x*	x*	x	x	x*	x
BRICKLAYING	a		*	*			*									*					
CABINET MAKING (Furniture)	159		x		x				x												
CARPENTRY	751	x	x							*	x		x		x	x*					
COSMETOLOGY	873			*		*						*							*		
DIESEL/TRUCK MECHANICS	255	?	?		?		x*	x			x	x		?						?	x
ELECTRICAL INSTALLATION & MAINTENANCE	371	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
ELECTROPLATING	33							x													
FURNITURE FINISHING	145		x		x				x												
MACHINE SHOP PRACTICE	413	x*	x*	x*	x*	x*	x*	x*	x	x*	x	x*	x	x	x*	x	x*	x	x*	x*	x
PLUMBING & STEAMFITTING	254				x			x						x	x						
DRAFTING	a	*	*		*			*													
PRACTICAL NURSING	370	*					*	*					*			*					
PRINTING	171						x*	x						?							
RADIO/TELEVISION REPAIR	a		*	*		*						*			*	*				*	
SEWING AND CUTTING	a		*		*																
SHEETMETAL WORK	353	x	?	x	x		x	x*	?		x	?		x	x					?	
TEXTILE—Knitting Machine Fixing	75		*		*							*									
TEXTILE—Loom Fixing	5											*									
TEXTILE—Spinning Frame Fixing	116																				
TOOL-AND-DIE MAKING	71	x		x			x	x				x									
UPHOLSTERY	320		x*		x*				x												
WELDING	246	x*		x*	x*		?	x*				?		?	x*		*		*	x	x
FARM MACHINERY REPAIR	a															*					

Key: x—Program allocated
?—Under consideration
*—Currently approved program offered or projected
a—No data on the number of workers needed; therefore, no allocation made

CHAPTER VIII

STUDENT POTENTIAL FOR SKILLED AND TECHNICAL EDUCATION

The manpower demand for technicians, skilled craftsmen, and skilled specialists in North Carolina is shown in another section of the report. Though the manpower demand is a major consideration, another important consideration in planning technical and trade education is the student potential aspect. That is, from where will the students come? How many students should be enrolled, not only to meet manpower requirements, but to meet the education needs and interests of the population?

STUDENT POTENTIAL DEFINED

For the purpose of this study, student potential is defined as the number of individuals for whom enrollment in technical and trade education would seem a wise course of action. This would not include those students whose abilities were less than that required for satisfactory completion and later on-the-job performance, nor those whose abilities were more appropriate to other fields of endeavor, such as four-year college programs. Thus, student potential for technical and trade education is the number of college-age youth whose abilities would seem to fit them better for technician and trade employment than for any other.

Though the Industrial Education Centers will enroll the greater proportion of this student potential, other institutions will continue to enroll many. Too, the student potential is not limited to the industrial field, but also includes potential technicians and tradesmen in such fields as agriculture, business, health, home economics, and other services.

Student potential, though difficult to estimate exactly, can, in principle, be determined. On the other hand, student demand, the number of individuals who will actually wish to enroll, is influenced by many factors. These factors are

1. The location of the school in relation to the student's home.
2. The transportation facilities available, including highways and school parking facilities.
3. The type of neighborhood in which the school is located.
4. The extent and quality of equipment the student sees when he visits the school.
5. The placement opportunities when he completes the program.
6. The prestige of the institution in the community.
7. The tuition fees and other costs, if any.
8. The extent to which the prospective student is acquainted with the program offered and the employment opportunities.

STUDENT POTENTIAL FOR TECHNICAL EDUCATION

Student potential for technical education is discussed here. Later in this section, the potential enrollment for trade and other type programs are discussed.

Based on methods used in a study[1] in Connecticut in which population data and the findings of the President's Commission on Higher Education were used, student potential for North Carolina was computed. The potential full-time enrollment equivalent for 1966 for two-year curriculums of technical type is approximately 11,500. This potential enrollment in the State is shown by county in Figure 3 and by six areas of the State in Table 20. The methods used in determining student potential are explained in Appendix I.

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[1] Gordon M. Harrington, *A Study of Need for Technical Institutes*, State Department of Education, Bul. No. 82, Hartford, Connecticut, 1957. pp. 38 and 39

STUDENT DEMAND FOR TECHNICAL EDUCATION

How does student demand compare with student potential for technical education? It should be remembered that *student potential* is based on the ability of people and is the number of individuals for whom enrollment in appropriate education would seem wise, while *student demand* is based on the interest and desire of people and is the number of individuals who will actually wish to enroll.

Ideally, technical education should be so organized and provided that the student potential and the student demand for technical education would be approximately equal. Even with the increased efforts in North Carolina in making educational opportunity available in technical education, it appears that the student potential will continue to be greater than the student demand. In other words, an examination of the factors listed previously which affect student demand in relation to the situation in North Carolina and the requirements for providing technical education suggest that student demand will be considerably less than the student potential.

A comparison of student potential and student demand can be seen in the estimated enrollments shown in Table 20. In arriving at the student demand enrollment, only individuals living within a thirty mile radius of an Industrial Education Center were considered. This was done to allow for the factor which probably affects student demand the greatest, i.e., location of institution in relation to the prospective student's home. The methods used in determining student demand are explained in Appendix I.

TECHNICAL EDUCATION EXTENSION PROGRAMS

An important function of institutions such as the Industrial Education Centers is to provide a large variety of technical education extension courses for the employed. Industry and employees are continually confronted with learning new technology as it is developed.

The potential enrollment for extension courses is large compared with the full-time student enrollment. If conditions are favorable, enrollment in extension technical education in the Centers is expected to be at least two times the number of full-time students enrolled. Some of the conditions which affect the demand for extension education are

1. The variety of courses available
2. The time courses are offered
3. Where the courses are offered
4. Commuting distance and availability of transportation.

TABLE 20. Estimated Student Potential and Student Demand Full-Time Enrollments in Technical Education in 1966, By State Area and By Industrial Education Center Commuting Area

State Area and Center Commuting Area	Estimated Full-Time Enrollment 1966[a]	
	Student Potential[b]	Student Demand[c]
AREA I	2364	900
Asheville IEC		338
Catawba IEC		239
Gastonia IEC		323
AREA II	1604	1072
Guilford IEC		481
Leaksville IEC		170
Winston-Salem IEC		421
AREA III	1729	1038
Charlotte IEC		537
Davidson IEC		187
Randolph IEC		161
Rowan IEC		153
AREA IV	1436	803
Burlington IEC		214
Durham IEC		236
Wake IEC		353
AREA V	1902	528
Fayetteville IEC		245
Goldsboro IEC		181
Sanford IEC		102
AREA VI	2478	763
Pitt IEC		224
Lenoir IEC		160
Wilmington IEC		224
Wilson IEC		155
Total	11,513	5,104

[a] See Appendix I for methods used in computing the estimated enrollments.
[b] Area covered in each area is shown in Figure 3, next page.
[c] Area covered is an approximate thirty-mile radius of a Center.

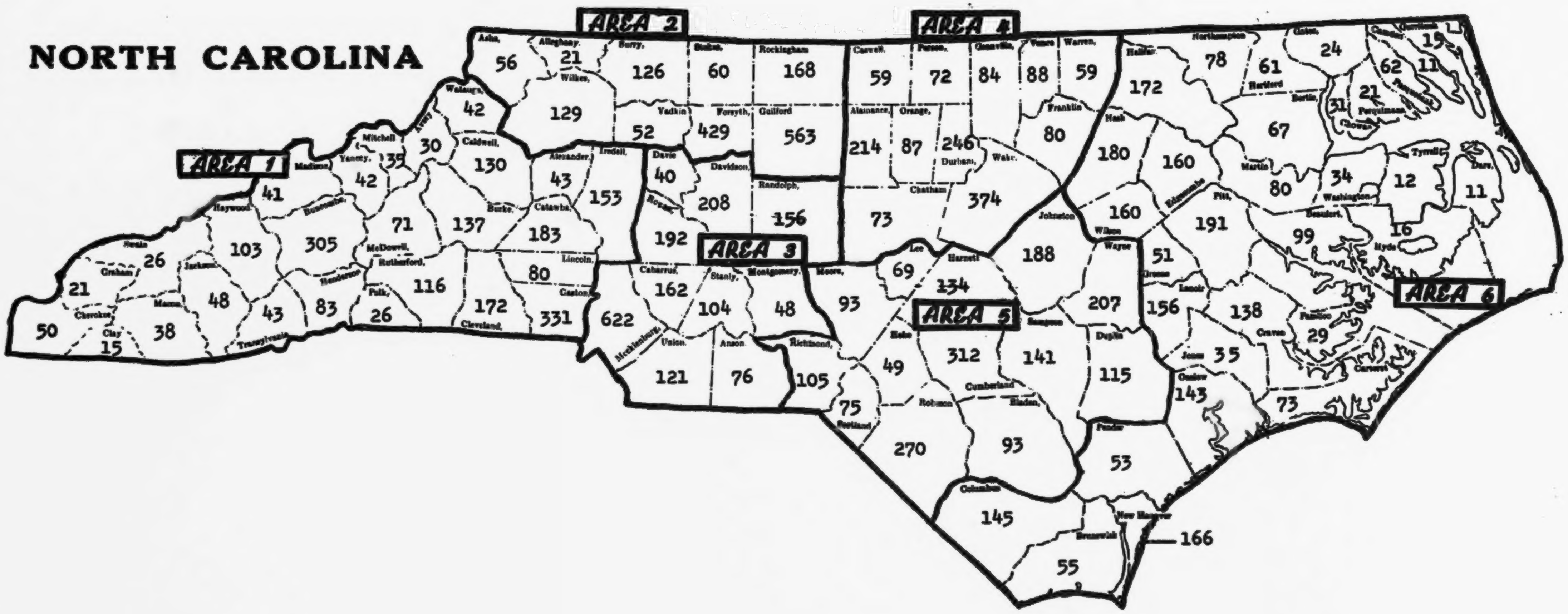
NORTH CAROLINA
AREA 1
AREA 2
AREA 3
AREA 4
AREA 5
AREA 6
56
21
126
60
168
59
72
84
88
59
172
78
61
24
19
62
11
42
129
52
429
563
214
87
246
80
180
160
67
31
21
30
35
42
130
43
153
40
208
374
73
160
191
80
34
12
11
41
103
305
71
137
183
192
156
188
51
99
16
26
21
48
43
83
26
116
172
80
331
622
162
104
48
93
69
134
207
156
138
29
50
15
38
121
76
105
75
49
312
141
115
35
143
73
270
93
53
145
166
55

FIGURE 3. Distribution of the Number of Potential Students to be Enrolled Full Time in Technical Education for 1966 in North Carolina.

TRADE EDUCATION PROGRAMS

In North Carolina, the opportunity for employment in the skilled trades is about three or four times that for technician jobs. Though some of the trade training is provided in existing high school programs and through on-the-job training and formal apprenticeship programs, much trades training should be provided in Industrial Education Centers, especially for persons beyond the high school age.

It is estimated that the potential enrollment for full-time trades training in the Centers is about 20,000 to 30,000.

SKILLED SPECIALISTS AND MACHINE OPERATOR PROGRAMS

Though no estimates are made regarding potential enrollment for operators type training, the need for such training is great. This program needs to be a flexible one which will meet the needs of people and industry as needed. Programs are usually needed when changes are made in industrial operations, when industries expand their scope of operations, or when new firms locate in North Carolina.

SUMMARY OF STUDENT POTENTIAL IN NORTH CAROLINA

Shown below is a summary of the estimated student potential enrollment by 1966 for the various types of programs offered in Industrial Education Centers and other similar institutions.

Type Program	Estimated Student Potential Enrollment by 1966
Full-time Technical Education	11,000
Extension Technical Education	22,000
Trade Education	25,000
Skilled Specialists	*No estimate*
Total	58,000

HIGH SCHOOL GRADUATES AND DROPOUTS

A 1961 follow-up study[2] of North Carolina high school graduates showed that 37 per cent of the 50,000 or 18,500 high school graduates, entered college. This leaves 31,500 graduates, many of whom need education beyond the high school. Also, many of the approximately 50,000 students who drop out before completing high school need and desire further education for which they could qualify, though it probably would not be of technician type.

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[2] State Department of Public Instruction, "Follow-up Survey North Carolina High School Graduates," Raleigh, 1961 (Mimeograph).

CHAPTER IX

PLANT AND EQUIPMENT NEEDS FOR EFFECTIVE INSTRUCTION

For all types of occupational training, it is essential that adequate and appropriate equipment be provided. This is especially true in the field of technician training where there is temptation to attempt to teach certain portions of the instruction through book study and classroom work rather than by means of the laboratory. The types of equipment needed for technician training are quite different from those required for instruction in the skilled crafts.

Shop equipment is utilized in skilled crafts training to develop skills in the manipulation and use of the equipment. The technology related to the craft is also taught, but the time devoted to this portion of the instruction is relatively lower than that given over to the shop processes. In technician training, however, the function of the laboratory equipment is to assist in developing technical understandings, rather than manipulative skills.

Some of the laboratory equipment used in technician training is used to develop basic scientific understanding, such as in physics or chemistry laboratories. Some of it is for the purpose of developing understanding of the technological principles of the specific field toward which the curriculum is aimed, such as equipment used for teaching industrial electronics control circuits. Some of the equipment used for technician training is similar to that used for skilled crafts training in, for example, the machine shop. For the skilled mechanic student this shop provides opportunity for developing the skills needed to operate the machines in turning out products to high standards of accuracy. The student in the technician training program uses it to develop understandings of the functions and uses of the various machines, and how the machine processes affect the work of product design, tool design, and the like.

Much special laboratory equipment is required for an adequately equipped school which offers technician training curriculums. In mechanical technology, for example, provision needs to be made for laboratory work in strength of materials, precision measurement, and basic aspects of metallurgy. The curriculum in civil technology for highway and heavy construction also needs laboratory equipment for strength of materials testing, designed to provide for the testing of concrete as well as metals. It also needs equipment for field work in surveying, and a soil mechanics laboratory. The chemical technology curriculum needs provision for laboratory work in unit operations, and the like, in addition to the basic chemistry laboratory. The instrumentation technology program requires equipment for teaching the construction and operation of many types of control instruments and their applications to process control. The equipment lists are derived from the content of the courses of study which make up the curriculums, which, in turn, are based upon detailed analysis of the duties of the various technician jobs in the cluster for which the curriculum provides training.

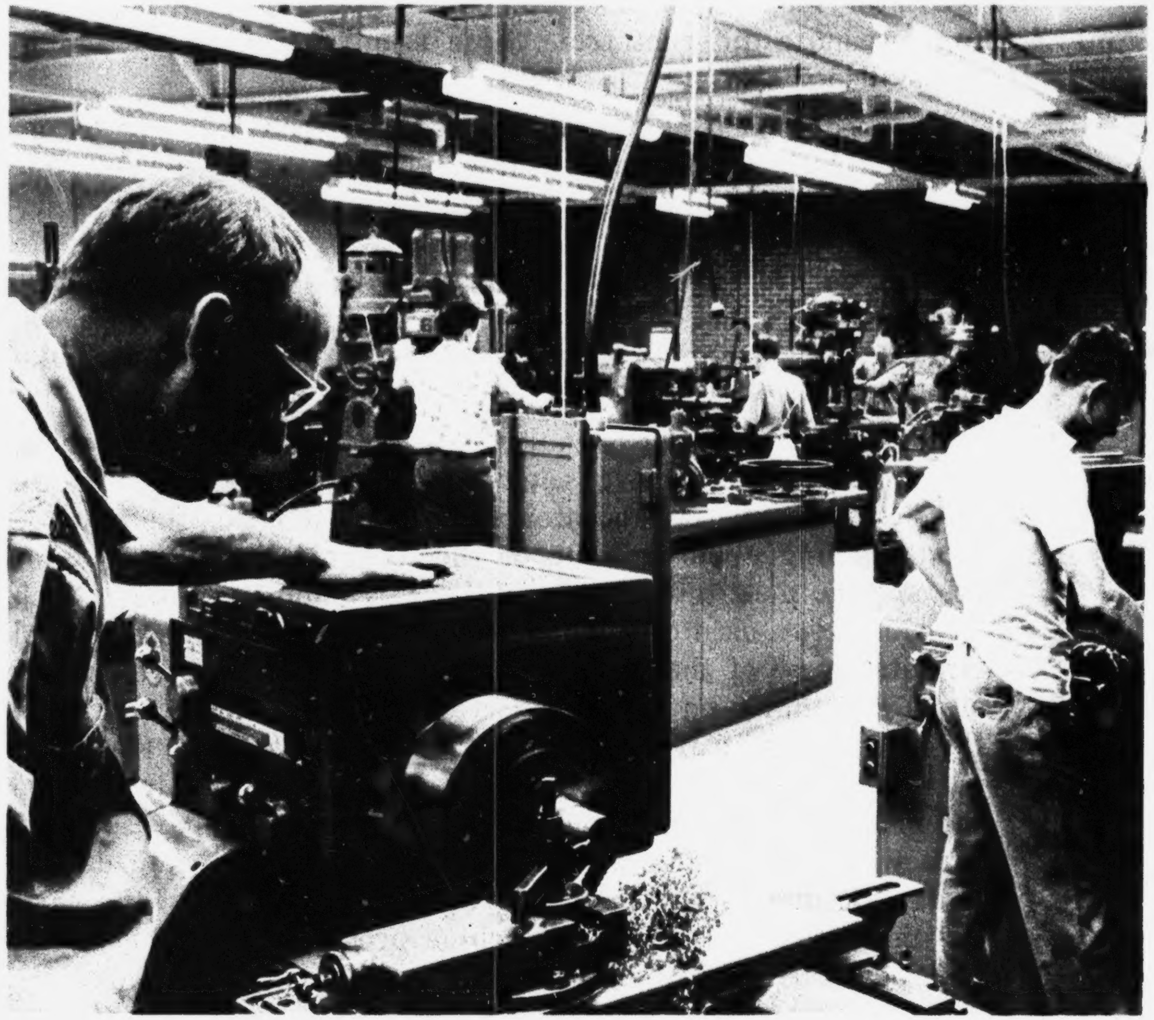
Attention is directed to the need for well-equipped libraries in schools which provide technician training. Reference books, technical periodicals, technical publications developed by manufacturers of technical equipment, and pertinent government publications in technical fields, all these have a place in the library.

Closed circuit television is finding an important place in the field of technical instruction. Teaching machines, using programmed learning instructional materials, are proving very effective.

The attractiveness of the physical plant of the Industrial Education Center has important bearing on student recruiting, and on making the Center a pleasant place to work and study. Classroom tables and chairs of modern design, abundant illumination, and well-maintained buildings are elements to be considered.

Some of the Centers will be providing full, two-year programs in the technician training fields. Other Centers may provide only the first year of instruction in certain curriculums. The equipment needs for the first-year portion of the curriculums usually are much less than those required for the second year in which the advanced specialized instruction is offered. Unless a Center offers the full two-year program of a given curriculum, it does not need to provide the expensive equipment required for certain of the second-year courses. Some of the Centers now have highly specialized equipment which may not be needed unless full programs are provided. It may be desirable to move some of this equipment to Centers offering the advanced work, and replace it with equipment more appropriate for the work of the first year.

The over-all building space required for technician training programs takes a different pattern from that needed for crafts training. In crafts training, shop space predominates, with small classrooms often placed adjacent to the shops. In technician training, the need for classrooms is much greater. In a typical technician curriculum which includes the general education needed, the student spends some 60 hours in classroom, for each 20 hours he spends in laboratory, and 20 hours in the drafting room.



CHAPTER X

STAFF QUALIFICATIONS

Instructors of shopwork in skilled crafts training are expected to be masters of their trades and to know how to teach. Over the many years during which skilled crafts training has been offered in public vocational schools, qualifications of such instructors have been adequately spelled out, and appropriate procedures have been developed for providing the teacher training needed. In the field of technician training, which is relatively new to most occupational training schools, the qualifications for technical instructors have not been so fully worked out, and appropriate instructor training programs have not been developed in many situations.

The technical instructor must have a thorough grounding in basic science and mathematics, be fully competent in the technology of his special technician field, and know how to teach technical subjects. Large numbers of present instructors in technician training programs have been recruited from the ranks of trained engineers. Such training provides an excellent base, provided it is supplemented by adequate, appropriate experience in technician work. Many types of engineering experience are quite different from the kind of work with which the technician is faced. The technician must be a master of applied technology, and must not only know the theory of the technological field but also must be skilled in the application of the theory of the practical day-by-day situations faced by him.

It is common practice in educational institutions to insist that the teacher have completed a higher level of education than students who are graduated from the program in which he teaches. Similarly, the teacher of the technology courses in a technician training program may well have more formal educational background than that represented by graduation from a technician training program. One must also take into consideration that many technician training programs are integral parts of junior/community colleges, and instructors in such programs need to measure up to the general standards set for all junior college teachers.

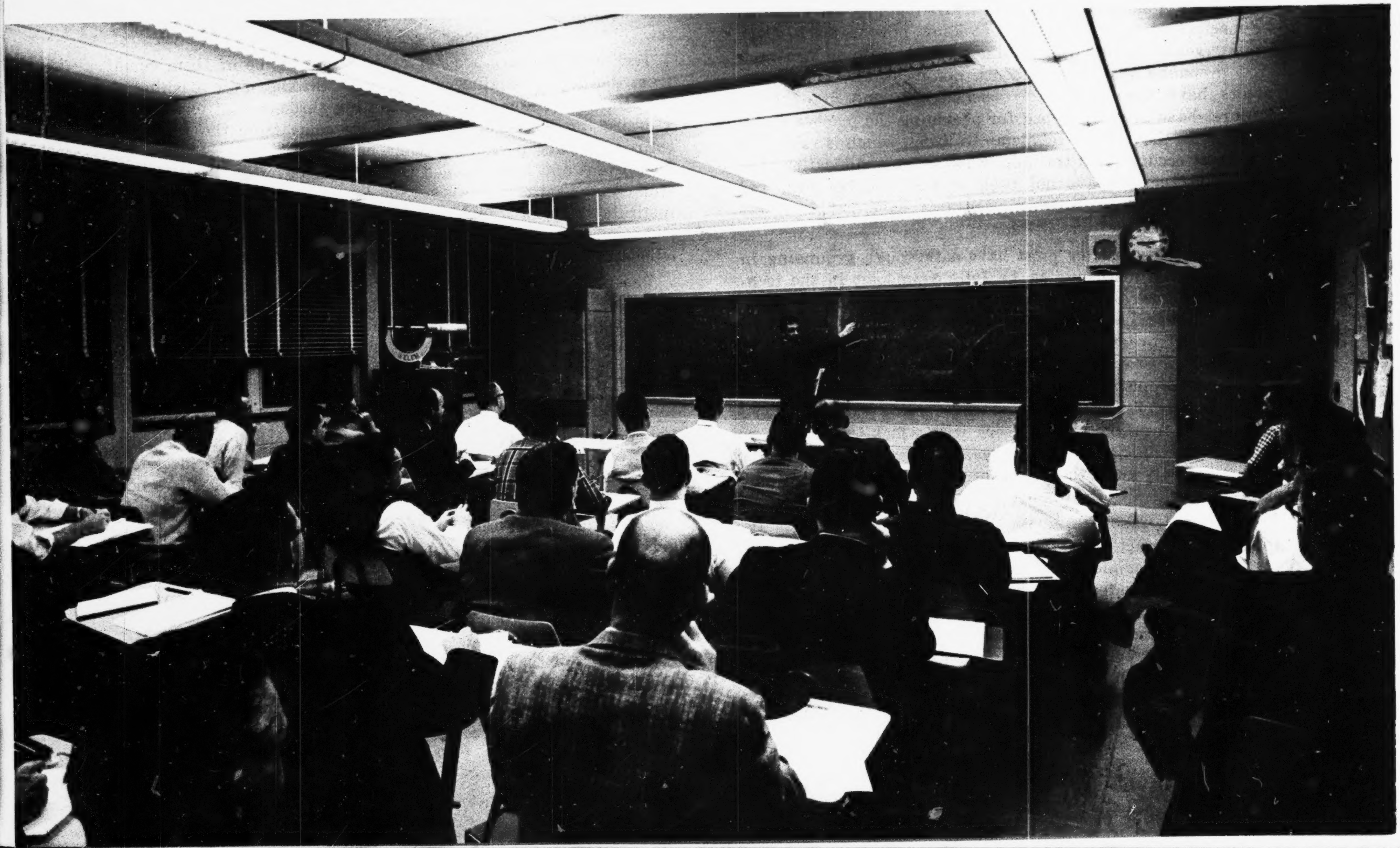
Technical teachers are not easy to find. Some of them come from the field of engineering, perhaps through first teaching a part-time extension course and getting through that experience a desire for full-time teaching. Some come from the ranks of retired military personnel. Some have had work experience as technicians and have learned their technology through informal study and part-time classes. Some are graduates of technical institutes who have had appropriate work experience. Most of them enter the teaching field with no preparation in professional education for teaching.

The personnel in teacher education institutions who are concerned with the training of technical teachers face the task of careful analysis of the duties of such teachers, and the development of appropriate teacher training services to meet their needs. Some of the training may well come through organized teacher training courses, offered at appropriate times to fit the schedules of those now employed as technical teachers. Some of it may come through individual help on the job. Perhaps additional ways may need to be devised in order fully to meet the needs. Incentives may have to be offered to induce teachers not fully qualified to make up their deficiencies. Some of these deficiencies may be in the field of technical competency or basic general education background.

The administrator of a technician training program should be sufficiently acquainted with the technologies of the curriculums he administers so that he can communicate effectively with his staff. A basic technical preparation is a very desirable asset, in some one of the fields of instruction offered in his school. He can then supplement this with self study to acquire the technical understanding essential for the other fields. Administrators with trade background will probably need to put forth effort to acquire the basic and applied technology needed, and the professional methodology necessary for technical teaching.

The curriculums will also include general education courses. The qualifications of instructors for these courses should probably be equal to those required for junior college teaching.

It is not within the scope of this report to suggest specific standards for instructors and administrators of technician training programs, or the ways in which competencies can be developed. It was felt, however, that the matter of qualified personnel is so important to the programs that attention should be called to the problem.



CHAPTER XI

STUDENT QUALIFICATIONS AND STUDENT RECRUITING

STUDENTS SERVED

One basic objective of the Industrial Education Centers is to meet the training needs of as many persons as possible, in all parts of the State, who desire training beyond the high school and who do not plan to attend college. The types of students served through the Centers include the following:

(a) Recent high school graduates
(b) Mature youth who have dropped out of high school
(c) Unemployed adults who desire retraining
(d) Employed workers who want to improve themselves in their present jobs, or who desire pre-employment training for new occupations
(e) Selected high school students who spend part time in the Centers while carrying on their high school programs

The training needs of these persons are many and varied. Not all of these needs can be met in the Centers. Some potential students live near the Centers; others reside at a considerable distance and will need to move from their present locations in order to get the training they desire. This usually involves additional financial outlay to meet the increased living expenses, and will make it impracticable for some of these students to get the training they desire. Yet all potential students within the State should know what the Centers offer and what requirements for admission must be met.

STUDENT QUALIFICATIONS AND SELECTION

The range of qualifications which must be met for students who enter the various training programs is wide. The qualifications needed for entrance into training programs for skilled specialty occupations are relatively low. Those required for admissions to the highly skilled technician training programs are high. Intellectual ability, potential aptitude for the various fields, and individual interest in the training programs must be considered. For some of the programs, previous experience in related occupations is necessary or desirable. For certain programs for the training of highly skilled technicians, the student must have completed certain specified courses in high school science and mathematics. In all cases, the student must be able to profit by the instruction. Some of the course offerings in the Centers are designed for special groups, such as apprentices in specific fields, or supervisors employed in industrial production. Most programs are open to any person who can meet the entrance qualifications.

If the Centers are to provide effective instruction, the students who enter the various programs must be selected carefully in the light of the requirements established for each program. The selection process takes into consideration the various devices which may be utilized for establishing the eligibility of prospective students. The high school achievement record may be examined. Selective tests will be utilized, including the GATB series of tests administered by the public employment offices. Other tests will be used for admission to the highly technical curriculums. Prospective students will be interviewed and appraised with respect to personal traits, physical handicaps, and the like. The screening process must be effective, and students should be admitted only to programs in which they will have reasonably good expectation of satisfactory accomplishment. The range of offerings in the Centers is sufficiently varied, with corresponding variations in criteria for admission, to meet the needs of persons with widely varying backgrounds and abilities.

STUDENT RECRUITING

The job of recruiting students is a formidable one. The tasks involved in most of the skilled occupations are generally known by many persons. Those of the technical occupations are often unknown or at least only partially familiar. One of the problems thus faced by those concerned with student recruiting is the informing of prospective students concerning occupational requirements.

Some students learn about the institution in which they seek training through their high school counselor or principal, or a teacher in the high school. Other sources of information may be a graduate or former student of the institution, an employer, or a friend. Or the information may come through reading a news release, a folder he comes across, or the visit to the high school by a representative of an Industrial Education Center.

In developing the student recruiting program of the Center, varied means of publicity are needed. Some of them are as follows:

(a) Folders describing the Center programs, prepared on a local or a state-wide basis.

(b) News releases in local newspapers, sometimes taking the form of a feature article.

(c) Visits to high schools by representatives of the Centers, for the purpose of talks before student assemblies or conferences with interested prospective students. Colored slides or motion pictures of Center activities are effective means of getting the message across to the school assembly.

(d) Career days at the Centers, to which prospective students are invited.

(e) Visits of high school counselors to the Center, individually or in groups on invitation by the Center director.

(f) Open house at the Center for friends of students and the general public.

Once the programs of the Centers are well established, and graduates find jobs in the communities where the Centers are located, the recruiting problem is not quite so acute as it is when the programs are just getting under way. Directors of the Centers may well exert considerable effort in recruiting during the months ahead.

The importance of active effort in recruiting women students should not be underestimated. If the needs of the total work force of the nation are to be met in the years immediately ahead, large numbers of women will need to be trained and placed in appropriate jobs. Some of the training programs of the Centers are designed primarily for women, such as those in cosmetology, practical nursing, power machine sewing, and technical secretarial work. Many other occupations have openings for women. Data gathered in the Manpower Study indicate that in 44 out of the 54 technical occupations investigated, women are employed. In a few of them women are preferred. This should be forcefully brought forth in the publicity developed for the Centers.

RECOMMENDATIONS CONCERNING THE OPERATION AND DEVELOPMENT OF THE CENTERS

During the past several months the staff engaged in the study of the Industrial Education Centers has had opportunity to note and to study many aspects of program development for the Centers. Growing out of observation, conference with informed persons, and study of the over-all situation, have come certain convictions with respect to future growth and development. These are outlined below, in the form of recommendations.

1. **Concentration of effort on adult and beyond-the-high-school programs**

   In the early days of public vocational education in America, many programs were offered at the elementary school level. Gradually, the age and grade level of these programs was raised; first, entrance requirement of 8th grade completion; then to 9th grade completion, to 10th grade completion, and to high school graduation. Although many programs for skilled crafts training, and some programs for technical training, are still offered at the high school level, the trend is definitely toward offering most of the specialized vocational education at beyond-the-high-school and adult level. Now is the time for the Industrial Education Centers to gear in with this trend as fully as possible.

   It is recommended that the Centers concentrate their effort on programs at the adult and beyond-the-high-school[*] level, and withdraw the present offerings for high school students except in such programs as provide direct relationship with the beyond-the-high-school program and where students will continue beyond the high school.

2. **Development of prevocational programs in the high schools**

   The upward shift of specialized vocational education to the post-high school level leaves a critical void in the high school program. Many high school students need learning activities different from those provided in the academic curriculums. If appropriate activities are not provided, many drop out of school and enter the surplus labor pool of the unskilled.

   Many other students continue through high school but obtain little instruction which permits them to explore pertinent occupational fields or to develop basic understandings and basic skills which would be of value of them in miscellaneous jobs or as preparatory work for advanced instruction in specialized industrial and technical programs. These students are found in all sizes of high schools, large and small. If their needs are to be met, a new type of program needs to be developed, one which might be offered in the smaller schools as well as in the larger ones.

   Such a program might well take the form of basic vocational education in appropriate fields, and prevocational and pretechnical offerings. This type of program would have some things in common with industrial arts but would differ from it in several respects. The development of such a program will require extensive research into the elements which are basic to, or common with, many different occupations; research concerning curriculum patterns that are feasible; research into the types of equipment needed which could be afforded, and the kinds of instructors required.

   Some specialized vocational training will probably need to be continued and perhaps expanded for a limited proportion of high school students who are potential drop-outs or who will not continue with any type of education beyond the high school. Such training would be aimed at preparing the students for a skilled specialty job rather than for skilled craftsmen or technician jobs.

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[*] NOTE: Wherever "beyond-the-high-school" or "post-high school" are used in this report, they refer to education beyond the high school in depth or planned for individuals who have passed the high school in maturity level.

Although the development of programs in the high schools is without the province of the Industrial Education Centers, it is discussed here since it has distinct bearing on the programs of the Centers.

It is recommended that a comprehensive study be made of the problem of vocational education at the high school level to the end that suitable basic and prevocational programs be developed to meet the needs on that level, leaving for the most part the specialized programs for the post-high school and adult years.

3. Expansion of Industrial Education Center programs into new fields.

The range of programs allocated and shown in Chapter VII for the Centers is fairly board, yet it does not provide training opportunities in a number of occupational fields. Vocational and technical schools in other parts of the United States include many programs not listed among those listed in Chapter VII. It is realized that the recent growth of the Centers has been extremely rapid and that strengthening of the present and proposed offerings should demand first attention. As soon as is practicable, attention should be given to some of the fields not presently covered. Among these are the following: aviation maintenance, metallurgy, technical photography, technical sales, nuclear isotopes, interior decoration, medical office assistants, medical laboratory technology, dietetic aides, accounting, banking, real estate, insurance, retail merchandising, secretarial technology with options in special fields, food service administration, hotel/motel administration, baking, commercial cooking, office machine repair, instrument repair, automatic vending machine maintenance, laundry and dry cleaning, small gasoline engine repair. It is suggested also that study be made of fields such as cosmetology, where present training opportunities are largely limited to private schools. If equal opportunity for free training is to be provided for all persons, program offerings in the Centers should be available in such fields as well as in those currently provided.

It is recommended that as soon as is practicable suitable studies be made of the desirability of offering training programs in selected fields not presently covered.

4. State-wide standardization of curriculum titles and curriculum content

Due to the rapid development of the Industrial Education Centers and the need for concentration of state administration effort in areas other than curriculum development, the titles of curriculums in specific programs and the content of the programs vary considerably from one Center to another. The occupational requirements which the graduates of these programs must meet are essentially the same, irrespective of where the job is found. It is thus desirable that standardization be developed so that all students may get the same training in specific curriculums. This is especially desirable when sudents take a portion of a curriculum in one Center and transfer to another Center for advanced work.

It is recommended that steps be taken to standardize the titles and the content of specific curriculums in all the Centers.

5. State-wide competency examinations

If the Centers are to meet the needs of industry, and if they are to develop prestige in the communities and in the State, it is necessary that appropriate standards of accomplishment be established and that steps be taken to insure that students completing the various curriculums meet these standards. One effective means toward this end is the development of standardized, comprehensive, theoretical and practical examinations held on a state-wide basis.

It is recommended that a system of competency examinations be developed and administered on a state-wide basis for all potential graduates of the Centers and used as one basis for conferring degrees and certificates.

6. Organization of curriculums on a semester-hour credit basis

Standard practice in most post-secondary schools in the

United States is to develop the curriculums with allocations to specific courses in the curriculums on a credit hour basis. A semester hour of credit is usually allowed for each hour of classwork per week carried on for a period of 15 to 18 weeks, with appropriate credit for laboratory and shop courses. A common practice is to allow one credit hour for each hour per week of classwork which requires up to two hours of outside study, one credit hour for two hours per week of laboratory work where substantial outside time is required for the preparation of reports, and one credit hour for three hours per week of shop work where little or no outside study is required. The present practice in the Centers is to allocate requirements on the basis of total clock hours per course and per curriculum. Toward the end that North Carolina Centers be in line with commonly accepted practice elsewhere, it seems desirable that the semester-hour basis be used. This would also fit into a trimester plan of operation. Some schools in other states use the quarter-hour basis for course credits, with one quarter-hour of credit allowed for one hour of classroom work, or the equivalent, for 12 weeks, as compared with 16-18 weeks for the semester-hour.

It is recommended that curriculums in the Centers be organized on the semester-hour or the quarter-hour basis.

7. Accreditation of curriculums

The prestige of an institution is often influenced by the accrediation of its curriculums by state, regional, or national agencies. Accreditation of a curriculum is usually given after thorough investigation of the curriculum organization and content, the qualifications of the faculty, the entrance requirements for students, the physical facilities for the program, the library facilities, and the like. In the field of technical education, it is common practice to accredit individual curriculums rather than institutions as a whole. Sometimes the accreditation takes into account the success of the graduates; thus accreditation of a new program must wait until graduates are on the job. On a national scale, the accreditation of technical institute curriculums is provided by the Engineer's Council for Professional Development. In some states, the accreditation is largely confined to State accreditation. The Industrial Education Centers should work toward some form of accreditation.

It is recommended that steps be taken for some form of accreditation of curriculums in the Centers as soon as is practicable.

8. Awarding of associate degrees and certificates

Suitable credentials need to be awarded to students who complete the work of the curriculums satisfactorily and who pass the proposed comprehensive examinations. For the present, this may well take the form of a suitable certificate indicating the type of program completed. As the programs become more comprehensive, and the level of work done reaches that commonly found in junior/community colleges, it may be desirable to consider the awarding of the Associate in Applied Science degree for completion of the two-year technical curriculums. Curriculums for which this degree is awarded should require high school graduation (or equivalent) plus completion of specific high school courses pertinent to the curriculum for admission, should include adequate pertinent general education courses, and should provide for total semester-hour credits of approximately seventy-two. In scope and level the content of the curriculum would be similar to that required for the Associate degree in accredited junior colleges. The awarding of such degrees will enhance the prestige of the Center in the eyes of prospective students, employers, and the general public. But awarding degrees should not be considered for curriculums that do not encompass the desirable scope and level.

It is recommended that consideration be given to the award of the Associate in Applied Science degree for appropriate technical curriculums as soon as they attain the required standards, and certificates be awarded for other types of curriculums.

9. Certification standards for instructional and administrative staff

The quality of an educational program is influenced greatly by the ability of its instructional and administrative staff. In the field of vocational industrial education, certification of instructors is usually based upon length and quality of occupational experience in the specific field, formal education background, appropriate personal traits, and completion of designated teacher training courses. The competency of the person in the occupational field is sometimes appraised by written and practical examinations. In the field of technical education, the formal education requirement may specify completion of an engineering or applied science degree. Certification requirements for administrators of technical schools often include teaching experience as a certified technical instructor and appropriate courses in technical education and administration culminating in the master's degree. The accreditation of programs by regional or national agencies takes into account the qualifications of the staff.

It is recommended that steps be taken to establish suitable certification standards, and to work toward fully qualified staff personnel as rapidly as is practicable.

10. Professional education programs for instructional and administrative personnel in the centers

If desirable certification standards are to be established and met, it will be necessary to provide adequate opportunity for present and potential staff members to obtain the professional training set up in the standards. The technology courses needed can usually be obtained by arrangements with engineering or applied science institutions. The professional courses needed by instructors and administrative staff usually are provided by schools of education.

It is recommended that appropriate steps be taken to provide adequate financing for needed programs in professional education and for making it possible for present staff members who may not fully meet the standards to take such professional courses as may be needed.

11. Student recruiting programs for the Industrial Education Centers

The Industrial Education Centers in North Carolina are relatively new, and it is probable that comparatively few people throughout the State are really acquainted with the opportunities they provide for youth and adults through full-time and part-time pre-employment training, and for the upgrading of employed workers. If the Centers are to provide their maximum service, the people of the State must be well acquainted with the educational programs they offer and the requirements which must be met by potential students. This can come about only through a comprehensive program of public relations, designed to acquaint prospective students, high school counselors, industrial employers, and the general public with the necessary information about the Centers and their offerings. Items such as a *state-wide catalog for the Centers* and motion pictures depicting the training opportunity are needed.

It is recommended that steps be taken to develop a state-wide program to inform prospective students, prospective employers, and the public in general of the educational opportunities in the Centers.

12. Satellite programs of the Centers

Small programs emanating from the Centers and administered by them have been planned for all Centers, and are now operating to a limited degree. As the allocation of satellite areas was made on the basis of fewer Centers than are now either in operation or in the process of development, the present over-all pattern of satellite affiliations needs revision. Effective extension courses which require little in the way of special equipment may well be offered in satellite locations, provided suitable instructors can be found and travel distances are not excessive between the Center and the satellite. Mobile equipment may well be used for certain types of programs. It is questionable whether pre-employment programs should be offered, except for short intensive programs where mobile equipment can be used.

It is recommended that study be made of the location of satellites in relation to the Centers, and of the nature of programs proposed, to the end that such programs be limited to those types which can function effectively.

13. Change of name of certain Centers

The title of "Industrial Education Center" is a good one for Centers which are mainly concerned with training programs for the skilled crafts. It is not so meaningful for the Centers where the program is largely of technician training type. For institutions which confine their offerings largely to well organized curriculums of high quality for the training of highly skilled technicians of the "engineering technician" type, a more meaningful title is "technical institute."

It is recommended that consideration be given to changing the name of Centers dealing primarily with technician training to a more meaningful title.

14. Administration, financing, and control of the Centers

Present practice provides that land and buildings for the Centers, and certain operating costs, be financed by the county in which the Center is located. Most of the funds for the operation of the Centers, however, come from the state. These include equipment, salaries of administrative and instructional staff, and other costs.

The local boards of education and the State Board of Education share control of the Centers. Lines of demarkation with respect to responsibilities of the State and the county in some administrative tasks are not clear. The crossing of county lines in the operation of the satellite programs, for example, presents problems, as does the recruitment of students. Although most of the equipment has been provided directly by the State, some has been furnished by the counties. In cases where it may be desirable to transfer equipment from one Center to another, this raises problems.

Until recent years, the vocational education program in the State of Connecticut operated on the basis of buildings and custodial services being supplied by the local community, with the instructional services provided directly by the State. Recently, this was changed to total financing and administration directly by the State. This change has greatly facilitated the large recent expansion of the industrial and technical education program of that State. In New York State, the development of the extensive technician training program in their Institutes of Applied Arts and Science was financed and administered directly by the State until the Institutes were firmly established, when the pattern was changed so that the local communities shared with the State in the financing and administration of the program.

The Industrial Education Centers of North Carolina are in a critical stage of development, with great potentialities for service if the program develops effectively and efficiently. It is important that the responsibilities of state and local government for support and control be carefully established and clearly stated.

It is recommended that the present method of support and control of the Centers be studied carefully and revised to bring it in line with the pattern developed for the comprehensive community college system.

15. Future consideration of industrial and technical education programs as divisions of junior/community colleges

In many sections of the United States there is a definite trend toward the placing of programs of industrial and technical education in the junior/community colleges as integral parts of the total program of these institutions. Associate degrees are awarded to students who enter the institutions as high school graduates and who complete comprehensive two-year, full time curriculums of high technician level. Students who may not have completed high school but who have had work experience, are 18 years of age or older, and who are capable of profiting from the instruction, are admitted to the curriculums which are appropriate to their needs. They receive certificates upon satisfactory completion of their curriculums. The junior/

community college carries prestige in the community. The industrial and technical students have access to varied general education courses, and have social and other activities in common with students in the academic curriculums. Transfer credit to higher educational institutions for technical students who decide to continue their studies often comes more readily through work done in an accredited junior/community college than if done in a separate technical school. The greater total enrollment of the institution is higher in the junior/community college, which includes varied types of offerings, thus permitting better facilities for social activities, library service, eating facilities, and the like.

The community college of comprehensive type offers the following programs:

(a) A transfer program, enabling the student to transfer to a four-year institution leading to a baccalaureate degree.

(b) A program of occupational training in industrial, technical, business, and other fields.

(c) A program of general education, not specifically leading to advanced education or to employment.

(d) A program of adult education paralleling part or all of the above, offered in the evening or at other hours when adults can attend.

The Industrial Education Centers are good starting points for the expansion of community colleges in North Carolina. In working toward this objective it may be desirable to undertake the task in stages, such as the following:

(a) Round out the occupational training offerings by the addition of programs in business, medical and health fields, agriculture, and other pertinent fields.

(b) Provide appropriate general education courses for students enrolled for occupational curriculums, and make a start toward transfer programs, through arrangements with appropriate higher educational institutions for extension courses.

(c) Enlarge the full-time faculties so that all the programs can be provided by the institution, itself.

It is realized that the development of community colleges out of the nucleus of certain of the Centers will take far-sighted planning, energy, time, and money. But such development appears to be in line with educational growth throughout the United States.

It is recommended that serious consideration be given to the development of certain appropriate Centers into comprehensive community colleges, following the pattern as outlined above, and at such time as appears feasible.

16. State-wide advisory committee

Local programs of industrial and technical education gain strength and acceptance in the community, and curriculums and courses of study are often developed or improved, through the services rendered by members of well-chosen advisory committees. Similarly, a state-wide advisory committee can render real service in the development of a state-wide program.

Such a committee might well be appointed by the State Board of Education. Its functions would be advisory only, and it should in no way assume any administrative authority.

It is recommended that consideration be given to the appointment of a state-wide advisory committee for the Industrial Education Centers.

17. Further expansion of Center programs

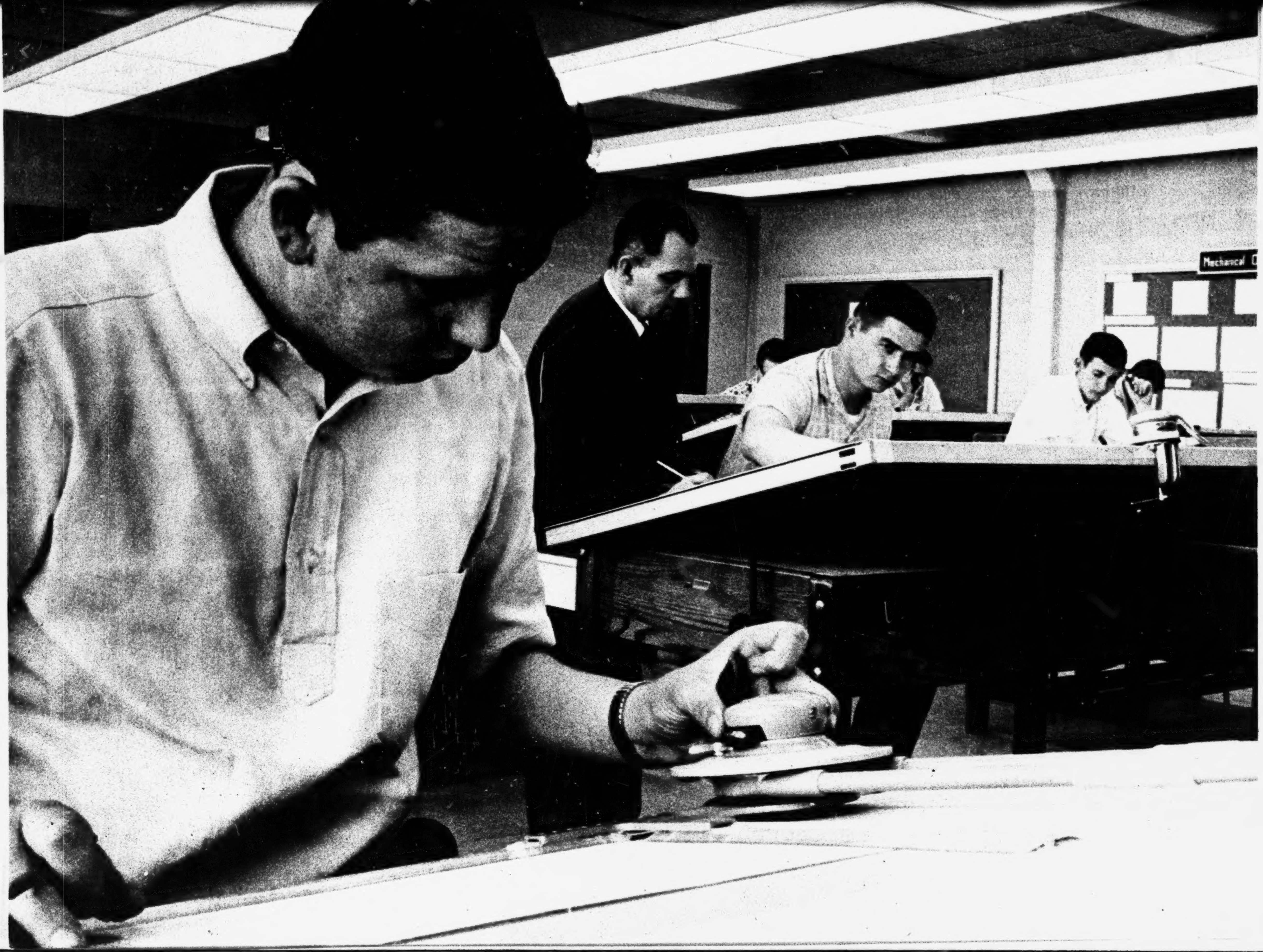
It is recommended that the state-wide program of Industrial Education Centers give increased emphasis to providing training in all fields of the world of work. Up to now, major emphasis has been given to determining educational needs and developing programs in the industrial field. Though some training is offered now in fields other than industrial, much remains to be developed in order to meet the educational needs existing in agriculture, business, and the various services such as health, home, and government services.

It is recommended that study and plans be made for the expansion of the Industrial Education Center offerings to *the extent that appropriate educational programs are provided in all fields of the world of work.*

18. Responsibility of the Centers to non-local potential students

The Centers have a responsibility to potential students, regardless of the students' origin of residence. Some Centers will have specific offerings different from other Centers, which students from various parts of the State would desire. Also, there will be students from out of state who desire admittance to the Centers. For students coming to Centers from all parts of the State, special services should be provided or arranged. In the case of out-of-state students, admission and tuition policies must be established.

It is recommended that necessary policy and plans be developed so that appropriate Centers will assume certain responsibilities for the non-local potential students.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APPENDIX A

STATE BOARD OF EDUCATION POLICIES FOR INDUSTRIAL EDUCATION CENTERS *

The 1959 General Assembly authorized "a vocational school known and designated as an industrial education center conducted for adults as well as mature or select high school students." G.S. 115-6 (6). The administration of schools of this type, as with the other types of public schools, is vested in the State Board of Education.

For the establishment and operation of Industrial Education Centers, the State Board has approved the following policies and regulations.

General Principles

1. Education in trade and industrial subjects shall be supplementary to the regular curriculum of the schools and shall complement instruction in basic fields of learning. (12-5-57)
2. The primary objective of this program of trade and industrial education shall be to enlarge the potential of the individual student through education in the knowledge and the skills which will be useful to him, and thus to his employer. In this way the program will contribute most to the development of the State as a whole. (12-5-57)
3. This program of trade and industrial education shall be constantly responsive to the needs of present and prospective industrial employees and thus sufficiently flexible, both in the curriculum and in the facilities provided, to meet those needs in different localities and under changing conditions. (12-5-57)
4. This program of instruction shall have clearly defined qualitative standards that will serve as incentives to each student to achieve in a manner and a degree meriting recognition by his school, his employer, and himself. The certificate awarded shall indicate the specific kind and quality of the student's achievement.
5. The constitutional mandate for a general and uniform system of public education, plus the State Board's assessment of the educational needs of the State, would require that this program be offered on a statewide basis to local units which demonstrate clear proof of need for this type of instruction, as well as the ability and the desire to support it.
6. Emphasis on these needs however must not derogate from other needs, either in general fields of learning or in other occupational fields. (12-5-57)

Outline of the Program

1. **Definition**—An Industrial Education Center shall be a school providing an advanced curriculum in trade and industrial subjects supplementary to the curriculum in the high school but below the college level. Its specific functions shall be to offer instruction which will prepare selected individuals for entrance into and progress in suitable wage-earning employment in trade and industrial pursuits.
2. **Students**—This instruction shall be available to both adults and selected high school students who have completed those courses that are prerequisite to the specific instruction desired and for whom specific job opportunities are available. Students living outside the administrative unit, but within commuting distance, may be enrolled in the Industrial Education Center through arrangements with the local administrative unit for reimbursement of its student share of the cost—if such is required. (12-5-57)
3. **Staff**
   - a. A full-time director qualified under standards set by the State Board shall supervise the instruction and otherwise administer the school. (12-5-57)
   - b. The title of Counselor-Coordinator is changed to Associate Director. (10-7-61)
   - c. The title of Assistant Director is established to replace titles of evening supervisor, evening principal, etc., heretofore used. (10-7-61)
   - d. Local boards of education shall use the same procedures for employment as those in effect for other public school employees. (3-6-58)
   - e. Personnel employed shall possess a certificate issued by the State Board of Education, and the permissible teaching areas shown on the certificate shall be observed. (3-6-58)
   - f. Clerical assistance shall be provided to the Industrial Education Centers under the terms established by the State Board of Education. (8-2-62)
4. **Compensation of Staff**
   - a. Teachers shall be paid from State and Federal funds under salary schedules established by the State Board. Local boards may supplement these salaries from local funds. (3-6-58)

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* These policies were codified by Fred Eason, Department of Curriculum Study and Research, as part of the research being conducted for the State Board of Education regarding established Board Policies. September 1, 1962.

b. In providing pre-employment post-high school technician education in Industrial Education Centers, full-time instructors may be paid and local units fully reimbursed up to the *$5 maximum hourly rate for hours of instruction. This method of paying these instructors may be used in lieu of the established salary schedule only for this type training and only when agreed to by the local advisory committee, the local school administration, and the Coordinator of Industrial Education Centers. (6-2-60)

c. The reimbursable rate of pay for supervisory and management development shall not exceed $10 per hour. (7-6-61)

d. Recommendations on the exact rate of pay may be made by the local administrative unit on the advice of the local advisory committee and shall require the approval of the Division of Vocational Education. (7-6-61)

e. When qualified adult or extension teachers are not available in the local community, reimbursement for travel at the State approved rate may be made on the approval of the state supervisor of the vocational service concerned. (7-6-61)

f. When it is considered necessary and advisable to employ a person of unusually high professional training or occupational competence the schedule above may be exceeded on the recommendation of the local advisory committee, the local administrative unit, and on the specific approval of the state supervisor of the service concerned and the State Director of Vocational Education. (7-6-61)

g. Beginning with the fiscal year 1963-64 reimbursement of local administrative units for the salaries of teachers who teach high school students in Industrial Education Centers shall not exceed three-fourths of the State salary schedule, the remaining one-fourth to be provided from local funds; provided, however, that this regulation shall not apply in any administrative unit in which the total number of actual (non-weighted) student contact hours of instruction of high school students did not exceed twenty-five per cent of the total number of actual (non-weighted) student contact hours of instruction delivered by the Industrial Education Center during the previous year. (8-2-62)

h. Directors shall be paid according to the salary schedule for Directors.

Associate Directors shall be paid according to the salary schedule for Associate Directors.

Assistant Director shall be paid according to the vocational teachers' salary schedule plus $40 per month.

(1) Reimbursement of local administrative units for the above-named positions shall be in accordance with the following terms and conditions:

(a) Monthly reimbursement in addition to the individual's salary as a certified teacher shall be paid for the months employed except that beginning July 1, 1963 for months in which the monthly enrollment average FTE, on the weighted scale, does not equal to at least fifty per cent of such monthly average for the preceding year, the Director shall receive only that proportion of the monthly salary beyond his vocational teacher's certificate rating which is represented by the proportion which the weighted enrollment FTE for such month or months bear to the average enrollment FTE for the year.

(b) In the case of any IEC to which any of the above positions have been allotted, but which has not been in operation and thus has no prior year's experience upon which to base weighted FTE enrollment, the minimum weighted full-time equivalent enrollment bracket (0-200) shall be used until the beginning of the second year of operation.

(c) In the case of individuals who hold earned doctor's degrees, an additional monthly $50 shall be paid.

(d) Directors who do not hold the master's degree shall be paid according to their vocational teacher's certificate; provided, however, that in the case of Directors employed prior to July 1, 1962 who do not hold a master's degree, the Director's salary, in addition to the amount of his vocational teacher's certificate, shall not exceed the amount of the monthly salary beyond his vocational teacher's certificate paid during 1961-1962 and shall not be less than $110 per month for 1962-1963. This provision shall terminate July 1, 1965.

(e) The monthly salary for Associate Directors shall not be paid to any individual who does not hold a master's degree, unless substantial work has been completed toward acquiring such a degree and the individual has given proof satisfactory to the Division of Vocational Education that he intends to complete the requirements for such a degree at an approved institution within a reasonable length of time.

(2) Determination of Weighted FTE Enrollments.
On the basis of periodic reports from each IEC, the Division of Vocational Education shall determine the Weighted FTE (full-time equivalent) Enrollment for each IEC for the preceding fiscal year by adding the quotients of the following:

(a) The total number of student contact hours of instruction given selected high school students, age 16 and over, divided by 2,160.

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* Maximum raised from $4 to $5; minimum set at $1.75 per hour. (7-6-61)

(b) The total number of student contact hours of instruction given in vocational subjects to non-high school students, age 18 and over, divided by 1,080.

(c) The total number of student contact hours of instruction given in technician curricula to non-high school students, age 18 and over, divided by 540.

(3) Determination of the Salary Scale.
The Director of the Division of Vocational Education shall have authority, for reimbursement purposes, annually to fix the monthly salary rate in the appropriate Weighted FTE Enrollment range in the Salary Schedule for each Director and each Associate Director, and in doing so, shall take into consideration, among other appropriate factors, the following:

(a) The degree of progress which the individual IEC has made toward the achievement of the general objectives of the IEC System as stated in the policy of the State Board of Education adopted by the State Board in April 1958 and approved by the Advisory Budget Commission then.

(b) The achievement of graduates of the individual IEC on State-wide examinations.

(c) The experience and general competence as an administrator and/or supervisor of vocational-technical programs. (8-2-62)

i. The amount of clerical assistance that is provided by State Aid funds to the Industrial Education Centers shall be determined by the number of full-time equivalent students enrolled in the Center.

(1) 0— 199 FTE Students ———— $1,200 State Aid
(2) 200— 499 FTE Students ———— $2,400 State Aid
(3) 500—1000 FTE Students ———— $3,600 State Aid

5. **Administration**—The Industrial Education Center, under the immediate supervision of a Director shall be administered by the local superintendent of schools and Board of Education under a state-wide plan supervised by the State Department of Public Instruction, according to regulations established by the State Board of Education. (12-5-57) Each school may have an advisory board appointed by the local Board of Education. The advisory board will be made up of men who know the industrial needs and are representative of the area served. (3-6-58)

6. **Occupational Surveys**—The Director of the Industrial Education Center shall be responsible for maintaining a complete, accurate, and continuous record of job opportunities in the area served by the school, in order that the curriculum of the school may be adjusted to the specific needs of students who will accept such employment. He shall maintain a record of placement of those students who have successfully completed courses of instruction. This information shall be available to both new and existing industries and shall be reported to the State Department of Public Instruction and on forms provided for this purpose. (12-5-57)

7. **Buildings**—Suitable buildings, including both shop and classroom space, shall be provided by the local administrative unit as a location, preferably apart from the high school, but within easy reach of the high school students. All buildings shall be approved by the State Board of Education and meet the standards outlined in "Standards Governing Students, Plants, and Facilities in Industrial Education Centers". (12-5-57)

8. **Operation of the Plant**—The regulations now applicable to the operation of public school buildings shall apply to the buildings used by the Industrial Education Centers, and they shall be recognized as participants in the State program of plant operation. (12-5-57) Not more than 3% of the equipment funds available for a center may be used for office equipment, library tables and chairs and general office equipment, provided suitable equipment cannot be obtained from surplus property. The remainder of the funds shall be used for shop and laboratory equipment. (9-4-58)

9. **Curriculum**—The curriculum offered in each school shall be highly responsive to the specific needs of students and for this reason shall be based on the findings of occupational surveys. Evidence of sufficient demand for instruction in a specific subject shall be present before a course is offered. The continuation of each course shall also be governed by the continued job opportunities offered to those who complete the training. (12-5-57) Programs in the areas of Distributive Education and Home Economics which are developed in the Industrial Education Centers shall operate within the general framework of policies established for the operation of the Industrial Education Centers. (8-3-61)

10. **Instructional Supplies**—An allotment shall be made by the State Board of Education, and this allotment shall be supplemented locally for the purchase of supplies used in instruction. The allotment shall be determined on a per-pupil basis which will vary from course to course. The State Department of Public Instruction shall recommend to the State Board of Education per-pupil scales for instructional supplies in each course of study. Per-pupil scales as recommended by the State shall constitute what is considered minimum; local units will be expected to enrich the curriculum with additional supplies. (12-5-57)

11. **Instructional Equipment**—The State shall provide for the purchase, installation, and maintenance of equipment. (12-5-57) The Controller is authorized to set up machinery necessary to release funds allocated to each center for purchase of equipment, upon requisitions bearing the signed approval of the Supervisor of Trade and Industrial Education. No purchase of equipment for which state funds are used shall

be made without authorization of the coordinator of Industrial Education Centers. (3-6-58)

Suitable equipment now in possession of or available to the sponsoring administrative unit shall be made available for use in the Industrial Education Centers. A special effort shall be made to encourage the State's surplus property division to locate and make available to the proposed schools equipment suitable for use by the school. Surplus property may include machines, motors, letter files, desks, typewriters, adding machines, hand tools, and other types of supplies. (12-7-57)

Title to equipment purchased from State funds shall remain with the State and may be transferred by the State Board of Education to another location when the local board of education has fulfilled the the training needs which necessitated the offering of a particular course. (3-6-58) The Coordinator of Industrial Education Centers and the Controller shall set up and maintain an inventory record on each piece of equipment purchased from State funds. All State-owned equipment shall have an identification plate, containing a serial number, and the statement "Property of State Board of Education." The Coordinator of Industrial Education Centers is authorized to purchase these plates. (12-5-57) Equipment loaned or donated by prospective employers may be accepted for temporary or permanent use upon approval of the local board of education. (12-5-57)

12. **Qualitative Standards**—Each course in the Industrial Education Center shall conform to the state-wide standards as to content and emphasis in areas where job requirements are similar. The State Superintendent of Public Instruction shall set minimum standards for course completion, and authorize the issuance of appropriate certificates to individuals who satisfactorily meet these standards. The standards for certificate issuance may be modified to meet changing industrial requirements. (3-6-58)

Administrative Relationships and Responsibilities

1. To be eligible for State aid, a training program must be administered and supervised by a county or city board of education. (3-6-58)
2. In the general administration and supervision of the program, the State Board of Education shall deal only with local boards of education. (3-6-58)
3. The responsibility for initiating a request for State aid shall rest with the board or boards of education in whose area the Industrial Education Center is desired. (3-6-58)
4. In applying for State aid, local boards of education shall:
   a. Give evidence of need for a program by certifying to the State Board of Education the needs as determined by an occupational survey. The occupational survey shall show the job opportunities in the area served and shall be submitted on standard forms provided for this purpose.
   b. Give evidence of financial ability and willingness to aid in maintaining a thorough and effective program of instruction. The local board of education shall provide suitable buildings, including both shop and classroom space. (3-6-58)

Criteria and Procedures for Determining Eligibility of Students

1. To be eligible for admission in classes for initial employment, a student must:
   a. Be not less than sixteen years of age—preferably a high school senior or an out-of-school adult; except, however, high school juniors meeting the age requirement may be considered eligible for courses organized for a period extending over two regular school years. (3-6-58)
   b. Be able to meet the admission requirements prescribed for each course of study by the State Department of Public Instruction. The qualitative standards for admission shall be based upon satisfactory completion of prerequisite courses, as well as tests and other determining factors which may be prescribed to insure the student's ability to meet job requirements. (3-6-58)
2. To be eligible for admission in upgrading classes, a student must be employed in the occupational area for which training is given. An upgrading class is defined as one offering instruction designed to increase the general efficiency of the employed adults. (3-6-58)
3. It shall be the responsibility of the local board of education to see that the criteria set forth in Sections 1 and 2 above are consistently observed. (3-6-58)
4. The State Board of Education shall review and, in its discretion, modify student admission standards to meet the changes brought about by change in industrial job requirements. (3-6-58)

Minimum Enrollment for Each Course

Without special permission from the State Board of Education, classes shall not be operated with less than fifteen students enrolled and an average attendance of ten in each course where training is offered for initial employment. A minimum enrollment of ten with an average attendance of six shall be permitted in the upgrading courses for adults. (3-6-58)

Length of Term and Attendance Day

1. Classes which include high school students shall be operated on a *three clock-hour basis and the calendar for such courses shall be concurrent with that of the public schools in the community. (3-6-58)

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* Changed from "two" to "three" to meet requirements of the U. S. Office of Education.

2. Classes which offer pre-employment instruction for adults and out-of-school youth shall operate not less than six hours and not more than forty hours weekly. The length of these courses will vary with the skills demanded by industry for initial employment and shall be determinded by the local board of education. (3-6-58)
3. The hours of operation of the Industrial Education Center shall be determined by the local board of education; provided, assigned full-time instructors reimbursed from State funds shall teach not less than six hours per day. (3-6-58)
4. Part-time or hourly instruction may be offered day or night. Reimbursement shall be made for such classes under the regulations established by the State Board of Education. (3-6-58)

State Supervision and Consultative Services

1. The State Superintendent of Public Instruction shall provide consultative services to local boards of education in order to improve the effectiveness of the program and to determine compliance with the State law and regulations. (3-6-58)
2. The State Superintendent of Public Instruction shall prepare all forms necessary for the administration of this program and shall have authority to require local boards of education to submit such reports and information as shall be essential to the operation of this program. (3-6-58)

Finance

The State Board of Education shall reimburse units on a monthly or quarterly basis for instructional salaries as requested by the administrative unit and on a quarterly basis for instructional supplies, plant operation and maintenance of equipment. (1-5-61)

Units

Where there is a need, a single course or curriculum may be established as a "Unit" (or subdivision) of the area Industrial Education Center, provided that adequate supervision can be given from the "parent" center.

Three criteria are needed:

1. Qualified students from an area rather than a single secondary school.
2. Local building facilities which meet the standards established.
3. Ability of the parent center to schedule the instruction and furnish the necessary equipment. (2-2-61)

A unit may be established by conducting a job-need survey and determining that fifteen or more qualified persons will avail themselves of the training offered. A request should be forwarded to the Division of Vocational Education, State Department of Public Instruction. (2-2-61)

What course or courses offered will depend upon local need. Units will operate at hours most suitable to students and the parent center. All teachers are employees of the local board of education and salaries are paid by the local board of education. The State Board of Education reimburses the local board fully for instructional salaries according to schedules adopted. All teachers must meet the educational and experience requirements as set forth by the Division of Professional Services. (2-2-61)

Relationship with the Employment Security Commission (12-3-59)

1. The State Board of Education, through the Division of Vocational Education, will purchase copies of *Part III of the Guide to The Use of The General Aptitude Test Battery* for each of the Centers. The Directors and Counselors of each Center will be trained in the interpretation and use of GATB scores in counseling by Employment Security Commission specialists.
2. Applicants for pre-employment training will be given the GATB by the Employment Security Commission and will complete the Employment Security Interest Check List and return it to the local Employment Security Commission office. Applicants whose GATB scores compare favorably with the information shown on the Interest Check List will be referred by the Employment Security Commission local office to the Center. Those applicants whose interest are not substantiated by GATB scores will receive counseling by the local Employment Security Commission office prior to referral to the Center.
3. GATB scores, the Interest Check List, and the nature of the counseling, if any, will be furnished the Center by the local office for each applicant.
4. Trainees, upon completion of their training at the Center, will be encouraged by the Department to return to their local Employment Security Commission offices and make application for employment.
5. Employers who make application to the Centers for graduate trainees will be encouraged to place orders for their needs with their local Employment Security Commission offices.
6. Should either the Employment Security Commission office or the Center receive from employers requests for graduate trainees and be unable to fill the requests immediately, each will contact the other for assistance in filling the orders.
7. The Employment Security Commission will assist the staff of the State Board of Education, as and if requested, in conducting area skill surveys

to determine training needs and in the application of occupational analysis techniques to determine the types of training needed for specific occupations or clusters of occupations.

8. This agreement is subject to change by the parties involved as needs for further mutual efforts are recognized for the successful selection and assignment of applicants for training and satisfactory placement of graduate trainees, or dissolution at the will of either agency.

APPENDIX B

SOME POST-HIGH SCHOOL INSTITUTIONS OFFERING TECHNICIAN TRAINING PROGRAMS

The following institutions, selected largely at random, illustrate the kinds of schools which offer full-time day programs in the various technologies. The data were obtained from school catalogs and from published lists of programs. Some of the schools have large enrollments in the specific curriculums listed; others have smaller enrollments. Geographical representation was considered, among other factors, in making the selection. For the more popular curriculums the number of schools listed is limited to ten. Many others might have been included. The programs shown are not necessarily approved as meeting all the requirements for Federal aid under Title VIII.

Air Conditioning and Refrigeration

Bakersfield Junior College, Bakersfield, California
College of Technology, University of Houston, Houston, Texas
Del Mar Technical Institute, Corpus Christi, Texas
Hudson Valley Technical Institute, Troy, New York
Long Beach City College, Long Beach, California
Milwaukee School of Engineering, Milwaukee, Wis.
New York State Agricultural & Technical Institute, Farmingdale, N. Y.
Oklahoma State University, Stillwater, Okla.
Southern Technical Institute, Chamblee, Georgia
Technical Institute of Temple University, Philadelphia, Pa.

Aviation Technology

Academy of Aeronautics, Flushing, New York
Aeronautical University, Chicago, Illinois
Compton District Junior College, Compton, California
Northrup Aeronautical Institute, Inglewood, California
Oklahoma State University, Stillwater, Oklahoma
Pasadena City College, Pasadena, California
Purdue University, Division of Technical Extension, Lafayette, Indiana
San Bernardino Valley College, San Bernardino, California
San Diego Junior College, San Diego, California

Chemical Technology

Casper Junior College, Casper, Wyoming
Chicago City College, Chicago, Illinois
Compton District Junior College, Compton, California
Erie County Technical Institute, Buffalo, New York
Ferris Institute, Big Rapids, Michigan
New York City Community College, Brooklyn, New York
New York State Agricultural & Technical Institute, Farmingdale, N. Y.
Northeastern Junior College, Sterling, Colorado
Ohio Mechanics Institute, Cincinnati, Ohio
Rochester Institute of Technology, Rochester, New York

Civil Technology (Including some highway construction programs)

Arlington State College, Arlington, Texas
Chicago Technical College, Chicago, Illinois
Hudson Valley Technical Institute, Troy, New York
North Dakota State School of Science, Wahpeton, N. D.
Oregon Technical Institute, Klamath Falls, Oregon
Sacramento Junior College, Sacramento, California
Southern Technical Institute, Chamblee, Georgia
Trinidad State College, Trinidad, Colorado
Utah State University, Logan, Utah
Wentworth Institute, Boston, Massachusetts

Computer Technology

Fort Hill College, Mt. View, California
Milwaukee School of Engineering, Milwaukee, Wisconsin
Orange Coast College, Costa Mesa, California

Diesel Technology

College of Technology, University of Houston, Houston, Texas
Long Beach City College, Long Beach, California
Milwaukee Institute of Technology, Milwaukee, Wisconsin
New York State Agricultural & Technical Institute, Alfred, New York
Oklahoma State University, Stillwater, Oklahoma
Oregon Technical Institute, Klamath Falls, Oregon
Wentworth Institute, Boston, Massachusetts

Drafting and Design Technology

Casper Junior College, Casper, Wyoming
Chicago City College, Chicago, Illinois
City College of San Francisco, San Francisco, California
New Hampshire Technical Institute, Manchester, N. H.
Oklahoma State University, Stillwater, Oklahoma
Pennsylvania State University, University Park, Pa.
San Jose Junior College, San Jose, California
Southern Illinois University, Carbondale, Illinois
Wentworth Institute, Boston, Massachusetts
Western Michigan University, Kalamazoo, Michigan

Electrical Technology

Arlington State College, Arlington, Texas
Flint Junior College, Flint, Michigan
Hudson Valley Technical Institute, Troy, New York
Long Beach City College, Long Beach, California
Montgomery Junior College, Takoma Park, Maryland
New York City Community College, Brooklyn, New York
Ohio Mechanics Institute, Cincinnati, Ohio
Oklahoma State University, Stillwater, Oklahoma
Rochester Institute of Technology, Rochester, New York
State Technical Institute, Hartford, Connecticut

Electronics Technology

Central Technical Institute, Kansas City, Missouri
City College of San Francisco, San Francisco, California
DeVry Technical Institute, Chicago, Illinois
Hillyer College, Hartford, Connecticut
Oklahoma State University, Stillwater, Oklahoma
Oregon Technical Institute, Klamath Falls, Oregon
RCA Institutes, New York, New York
Santa Monica City College, Santa Monica, California
Southern Technical Institute, Chamblee, Georgia
Technical Institute of Temple University, Philadelphia, Pa.

Fire Protection Technology

Oklahoma State University, Stillwater, Oklahoma

Industrial Laboratory Technology

Bakersfield College, Bakersfield, California
Fresno City College, Fresno, California
Hudson Valley Technical Institute, Troy, New York
New York State Agricultural & Technical Institute, Alfred, New York

Industrial Supervision

Fresno City College, Fresno, California
Los Angeles Trade-Technical Junior College, Los Angeles, California
San Diego Junior College, San Diego, California

Industrial Production Technology

Erie County Technical Institute, Buffalo, New York
Grand Rapids Junior College, Grand Rapids, Michigan
Lain Technical Institute, Indianapolis, Indiana
Milwaukee School of Engineering, Milwaukee, Wisconsin
Pennsylvania State University, Division of Extension, University Park, Pa.
Port Huron Junior College, Port Huron, Michigan
Purdue University, Division of Technical Extension, Lafayete, Indiana
Southern Technical Institute, Chamblee, Georgia
University of Toledo, Toledo, Ohio
Wentworth Institute, Boston, Massachusetts

Inspection

San Diego Junior College, San Diego, California

Instrumentation Technology

Del Mar Technical Institute, Corpus Christi, Texas
Hillyer College, Hartford, Connecticut
New York State Agricultural & Technical Institute, Farmingdale, N. Y.
New York State Agricultural & Technical Institute, Morrisville, N. Y.
Pasadena City College, Pasadena, California
Pensacola Junior College, Pensacola, Florida

Mechanical Technology (See also Industrial Production Technology)

Arlington, State College, Arlington, Texas
Chicago Technical College, Chicago, Illinois

Coffeyville College, Coffeyville, Kansas
Hibbing Junior College, Hibbing, Minnesota
Los Angeles Trade-Technical Junior College, Los Angeles, California
New York City Community College, Brooklyn, New York
Ohio Mechanics Institute, Cincinnati, Ohio
Rochester Institute of Technology, Rochester, New York
Southern Technical Institute, Chamblee, Georgia
State Technical Institute, Hartford, Connecticut

Metallurgical Technology

Erie County Technical Institute, Buffalo, New York
Henry Ford Community College, Dearborn, Michigan
Pueblo Junior College, Pueblo, Colorado

Photographic Technology

City College of San Francisco, San Francisco, California
East Los Angeles Junior College, Los Angeles, California
New York State Agricultural & Technical Institute, Farmingdale, N. Y.
Oakland Junior College, Oakland, California
Rochester Institute of Technology, Rochester, New York
Santa Monica City College, Santa Monica, California

Technical Illustration

El Camino College, El Camino College, California
Los Angeles Trade-Technical Junior College, Los Angeles, California
New York City Community College, Brooklyn, New York
Oregon Technical Institute, Klamath Falls, Oregon
Williamsport Technical Institute, Williamsport, Pennsylvania

Technical Sales

New York City Community College, Brooklyn, New York

Tool Technology

Alliance College, Cambridge Springs, Pennsylvania
Henry Ford Community College, Dearborn, Michigan
Lain Technical Institute, Indianapolis, Indiana
New Hampshire Technical Institute, Portsmouth, New Hampshire
Rochester Institute of Technology, Rochester, New York
San Diego Junior College, San Diego, California
Santa Ana College, Santa Ana, California
Southern Illinois University, Carbondale, Illinois
State Technical Institute, Hartford, Connecticut
Wentworth Institute, Boston, Massachusetts

APPENDIX C

COMPARATIVE ANALYSES OF CURRICULUMS IN SELECTED FIELDS OF TECHNICIAN TRAINING

TABLE C-1. Analysis of Curriculums in Instrumentation Technology

	CREDIT HOURS*					
	A	B	C	D	E	F
MATHEMATICS						
Algebra Through Quadratic Equations	3	3	2	2	3	1½
Trigonometry (Right & oblique triangle)	2	2	1	2	3	3
Logarithms & Slide Rule Usage	2	1	1	2	2	1½
Applied Calculus	3			4	3	3
Boolian Algebra—Theory of binary computation						3
Graphical analysis of measurement and control problems						3
SCIENCE						
Mechanics & Heat	4	4	12	4	4	3
AC Current (Theory & lab.)	4	5	2	4	4	1½
DC Current (Theory & lab.)	4	5	2	4	4	1½
Industrial Electronics (Theory & lab.)	4	5	6	4	4	3
Optics, Heat						3
Hydraulics, Solid-state Physics						3
Advanced Electronics						3
GENERAL EDUCATION						
Communications Skills	3	6	6	3	3	
Employer-Employee Relations	3	3		3	3	
Technical Report Writing	3			3	3	3
American History		6	6			
Social Science			6			
TECHNOLOGY						
Pressure & Flow Measuring Devices	3	5	6	3	3	1½
Temperature Instruments	3	5	6	3	3	1½
Analytical Instrumentation (Used in industrial process equipment)	4	3		4	4	3
Automatic Control Instruments	9	3	6	3	3	6
Automatic Control Systems	3		6	6	9	6
Process Control Problems & Design	4			4	4	3
Chemical Processes						3
Physical and Chemical Measurement						3
Computer Technology						3
Design & Operation of Measurement Equip.						3
Power Utility Instrumentation						3
ADDITIONAL KNOWLEDGE & SKILLS						
Fundamentals of Drafting	3	5	2	6	3	
Machine Shop Operations	2			2	2	
Mechanical Drafting	3		2		3	3
Strength & Properties of Materials		5				
Industrial Processes (Metal working)						3
TOTALS	69	66	72	66	70	78

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*A—Division of Extension, Industrial Education Department, University of Texas;
B—Pensacola Junior College, Pensacola, Florida;
C—Agricultural & Technical Institute, Morrisville, New York, (Aircraft Instrumentation);
D—Del Mar Technical Institute, Corpus Christi, Texas;
E—A Typical Program Shown in Paper No. 58-A-179, American Society of Mechanical Engineers;
F—Suggested Curriculum—Instrument & Control Engineering by Lloyd Slater, FIER Bulletin No. 97.

TABLE C-2. Comparison of Electrical Curriculums in Selected Two-Year Post-High School Programs

SEMESTER HOURS

SCHOOL	Electrical Technology	Related Technology	Mathematics	Physics	Drawing	General Education	Electives	Total
Oklahoma Contract Program	47.5	1	7	4.5 chem. 3.5	6.5	7	—	77
Pennsylvania State Univ. Ext. Tech. Inst.	31	2	10	6	4	15	—	68
Wentworth Institute Boston	34	16	13	8	4	5	—	80
State Agri. & Tech. Inst., Alfred, N. Y.	37	1	12	8	4	12	12	74
Gastonia Tech. Inst. Gastonia, N. C.	32	2	10	12	5	15	—	76
Westchester Comm. College, Valhalla, N. Y.	38	—	6	8	2	20	—	74
Bakersfield College Bakersfield, Calif.	19	—	9	6	3	24	7	68
Del Mar Institute Corpus Christi, Texas	44	2	6	—	6	9	—	67
Palm Beach Junior College, Palm Beach, Cal.	35	—	10	8	3	15	—	71
Southern Tech. Inst. Chamblee, Georgia	47	—	9	7	5	12	—	80
Median	36		9.5	8	4	13.5		74
Range	19—47.5	1—16	6—16	0—12	2—6.5	5—24	0—12	67—80

TABLE C-3. Comparison of Electronics Curriculums in Selected Two-Year Post-High School Programs

SEMESTER HOURS

SCHOOL	Electrical-Electronic Technology	Related Technology	Mathematics	Physics	Drawing	General Education	Electives	Total
Oklahoma Contract Program	53.5	1	7	4.5	6.5	7	—	79.5
Lindsay-Hopkins Center Miami, Florida	32	—	20	2	2	16	—	72
Oregon State Educ. Dept. Curriculum	35.4	—	8	5.4	2.7	8	—	59.5
Oregon Technical Inst. Klamath Falls	47.3	—	5.3	2.7	—	2	12	69.3
Orange Coast College Costa Mesa, Calif.	36	—	9	6	—	17	—	68
San Diego Jr. College California	35	—	6	6	—	16	—	63
Chicago Junior College Chicago	21	—	7	6	9	18	3	64
Gastonia Technical Inst. Gastonia, N. C.	32	2	10	12	5	15	—	76
Temple Univ. Tech. Inst. Philadelphia	47	—	16	6	—	3	—	72
Wentworth Institute (Ind. Electronics) Boston	47	4	13	8	3	5	—	80
Median	35.7		8.5	6	2.4	11.5		70.6
Range	21—53.5		5.3—20	2—12	0—9	2—18		59.5—80

TABLE C-4. Comparison of Electrical and Electronic Curriculums (Oklahoma Contract Curriculums)

COURSES SPECIAL TO THE ELECTRICAL CURRICULUM		COURSES COMMON TO BOTH CURRICULUMS		COURSES SPECIAL TO THE ELECTRONIC CURRICULUM	
TECHNOLOGY		TECHNOLOGY		TECHNOLOGY	
Electrical installation	3.5	Direct current circuits	6.0	Basic electronics	6.0
Electrical instruments and measurement	3.5	Alternating current circuits	6.0	Circuit tracing	2.5
Alternating current machines	5.5	MATHEMATICS		Special electronic circuits—design and analysis	6.0
Industrial electronics	4.5	Algebra & trigonometry	4.0	Transmitter theory & operation	6.0
Electrical control circuits	4.5	Applied analytics & calculus	3.0	Ultra-high frequencies and microwaves	6.0
Electrical power transmission and distribution	4.5	SCIENCE		Television circuits	6.0
Electrical equipment maintenance	5.0	Mechanics—statics & dynamics	4.5	Industrial electronics	6.0
Electrical specialty	4.5	DRAWING		Research report—special problem	3.0
SCIENCE		Technical drawing	4.0		
Industrial chemistry	3.5	Graphic analysis	2.5		
		GENERAL SHOP	1.0		
		GENERAL EDUCATION			
		Social Science	3.0		
		Communication skills	3.0		
		Technical report writing	1.0		
Total Sem. Hrs.	39.0	Total Sem. Hrs.	38.0	Total Sem. Hrs.	41.5

APPENDIX D

TYPICAL CURRICULUMS IN SELECTED FIELDS OF TECHNICIAN TRAINING

TABLE D-1. A Proposed Curriculum for A Two-Year Post-High School Program in Business Data Processing

FIRST YEAR

First Semester	Class	Lab.	Study	Total
Data Processing Mathematics	3	0	6	9
Basic Computing Machines I	2	1	5	8
Electro-Mechanical Machines	5	5	15	25
Communications Skills I	3	0	6	9
	13	6	32	51

Second Semester	Class	Lab.	Study	Total
Data Processing Mathematics II	3	0	6	9
D. P. Applications	5	5	15	25
Basic Programming Systems	3	1	7	11
Communications Skills II	3	0	6	9
	14	6	34	54

SECOND YEAR

Third Semester	Class	Lab.	Study	Total
Computer Programming I	3	2	8	13
Advanced Computing and Programming Systems	3	0	6	9
Business Statistics	3	2	8	13
Business Organization	3	0	6	9
	12	4	28	44

Fourth Semester	Class	Lab.	Study	Total
Computer Programming II	5	3	13	21
Business Systems and Procedures	3	2	8	13
Data Processing Field Project	0	3	7	10
Social Science	3	0	6	9
	11	8	34	53

TABLE D-2. Electrical Technology Curriculum

FIRST YEAR

First Semester			Class	Lab.	Total	Credit
ER	114	Technical Mathematics I (Algebra & Trigonometry)	4	0	4	4
ER	115	Direct Current Circuits & Machines	3	6	9	5
G	113	Social Science	3	0	3	3
G	123	Technical Drawing	1	6	7	3
G	133	Communication Skills	3	0	3	3
			14	12	26	18

Second Semester			Class	Lab.	Total	Credit
ER	164	Technical Mathematics II (Applied Analytical Geometry & Calculus)	4	0	4	4
ER	185	Time Varying Circuits	3	6	9	5
ER	165	Basic Electronics	3	6	9	5
G	111	Shop Processes	0	3	3	1
G	161	Technical Report Writing	1	0	1	1
G	162	Graphic Analysis	1	3	4	2
			12	18	30	18

SECOND YEAR

Third Semester			Class	Lab.	Total	Credit
G	204	Engineering Science	3	3	6	4
E	213	Electrical Instruments & Measurements	4	3	5	3
E	215	Alternating Current Machines	3	6	9	5
E	272	Electrical Installation Planning	2	0	2	2
G	213	Chemistry and Applications in Electricity	2	3	5	3
			12	15	27	17

Fourth Semester			Class	Lab.	Total	Credit
E	264	Industrial Electronics	3	3	6	4
E	274	Electrical Control Circuits	3	3	6	4
E	284	Electrical Power Systems—In-Plant (with utility systems option)	3	3	6	4
E	294	Operating Problem Analysis	2	6	8	4
			11	15	26	16

Course Letters:
ER—Technical specialized courses common to Electronics and Electrical curriculums
G —General and related courses
E —Technical Electrical courses
1 semester=17 weeks

TABLE D-3. Electronic Technology Curriculum

FIRST YEAR

First Semester			Class	Lab.	Total	Credit
ER	114	Technical Mathematics I (Algebra & Trigonometry)	4	0	4	4
ER	115	Direct Current Circuits & Machines	3	6	9	5
G	113	Social Science	3	0	3	5
G	123	Technical Drawing	1	6	7	3
G	133	Communication Skills	3	0	3	3
			14	12	26	18

Second Semester			Class	Lab.	Total	Credit
ER	164	Technical Mathematics II (Applied Analytical Geometry & Calculus)	4	0	4	4
ER	185	Time Varying Circuits	3	6	9	5
ER	165	Basic Electronics	3	6	9	5
G	111	Shop Processes	0	3	3	1
G	161	Technical Report Writing	1	0	1	1
G	162	Graphic Analysis	1	3	4	2
			12	18	30	18

SECOND YEAR

Third Semester			Class	Lab.	Total	Credit
G	204	Engineering Science	3	3	6	4
R	212	Circuit Tracing	1	3	4	2
R	215	Special Electronic Circuit Design & Analysis	3	6	9	5
R	225	Transmitter Theory & Operation	3	6	9	5
			10	18	28	16

Fourth Semester			Class	Lab.	Total	Credit
R	262	Research Report (Special Problem)	0	6	6	2
R	265	Ultra-High Frequencies & Microwaves	3	6	0	5
R	275	Television Circuits	3	6	9	5
R	285	Industrial Electronics	3	6	9	5
			9	24	33	17

Course Letters:

ER—Technical specialized courses common to Electronics and Electrical curriculums
G— General and related courses
R —Technical Electronic courses
1 semester=17 weeks

TABLE D-4. Mechanical Technology Curriculum

FIRST YEAR

First Term*	Class	Lab.	Credit
Tech. Math I	5	0	5
Tech. Drawing I	0	6	3
Metals Lab. I	0	3	1
Tech. Report Writing	3	0	3
Physics I	3	2	4
Electricity I	4	2	5
Physical Education	0	2	1
Total	15	15	22

Second Term	Class	Lab.	Credit
Tech. Math II	5	0	5
Tech. Drawing II	0	3	1
Metals Lab. II	0	3	1
Physics II	3	2	4
Electricity II	4	2	5
General Chemistry I	4	2	5
Physical Education	0	2	1
Total	16	14	22

Third Term	Class	Lab.	Credit
Tech. Math III	5	0	5
Public Speaking	3	0	3
Applied Mechanics	4	0	4
General Chemistry I	2	2	3
Tech. Drawing III	0	6	3
Metals Lab. III	0	3	1
Electrical Machinery	3	0	3
Physical Education	0	2	1
Total	17	13	23

SECOND YEAR

Fourth Term	Class	Lab.	Credit
Calculus I	4	0	4
Strength of Materials	4	0	4
Mtls. of Engineering	3	0	3
Metals Lab. IV	0	3	1
Mfg. Processes	3	0	3
Mechanisms	3	3	4
Electronics	3	2	4
Physical Education	0	2	1
Total	20	10	24

Fifth Term	Class	Lab.	Credit
Calculus II	4	0	4
Economics	4	0	4
Fluid Mechanics	4	0	4
Machine Design I	5	3	6
Materials Test Lab.	0	3	1
Methods Time Measurements	4	2	5
Total	21	8	24

Sixth Term	Class	Lab.	Credit
Industrial Org. & Mgt.	4	0	4
Human Relations	2	0	2
Heating and Air Conditioning	4	2	5
Machine Design II	6	6	9
Mfg. and Tool Costs	3	0	3
Statistical Quality Control	3	0	3
Total	22	8	26

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* Term consists of 13 weeks

TABLE D-5. Chemical Technology Curriculum

FIRST YEAR

First Term*	Credit Hours
Tech. Math (Algebra)	4
Mechanics & Light	5
General Chemistry	6
Economics	3
Communication Skills	4
Orientation	1
Health Education	1
	24

Second Term	Credit Hours
Tech. Math (Trig. & Anal. Geometry)	4
Heat	5
General Chemistry	5
Human Relations	3
Communication Skills	4
Orientation	1
Health Education	1
	23

Third Term	Credit Hours
Calculus	4
Electricity	5
Quantitative Analysis	7
Communication Skills	4
General Chemistry	3
	23

SECOND YEAR

First Term	Credit Hours
Quantitative Analysis	6
Intro. Physical Chemistry	4
Unit Operations	5
Calc. of Analytical Chem.	3
Industrial Safety	1
Library Techniques (option)	5
	19

Second Term	Credit Hours
Qualitative Analysis	5
Organic Chemistry	5
Unit Operations	5
Industrial Stoechiometry	3
Library Techniques (option)	5
Industrial & Labor Relations	3
	21

Third Term	Credit Hours
Instrumental Methods of Analysis	4
Unit Operations	5
Industrial Stoechiometry	3
Organic Chemistry	5
Field Trips	2
Library Techniques	5
	19

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* Term equals 12 weeks

TABLE D-6. Mechanical Technology Curriculum Outline (Design Major)

FIRST YEAR

Course Title	Class Hours	Lab. Hours	Credit Sem. Hrs.
First Term			
Orientation	1	0	0
Materials of industry	3	0	3
Mechanical Drafting I	2	6	4
Manufacturing processes I	2	3	3
Mathematics I	5	0	5
Communication skills	3	0	3
	16	9	18
Second Term			
Technical reporting	2	0	2
Manufacturing processes II	2	3	3
Mechanical drafting II	2	6	4
Mathematics II	4	0	4
Mechanics and heat	4	4	5
	14	13	18

SECOND YEAR

Course Title	Class Hours	Lab. Hours	Credit Sem. Hrs.
Third Term			
Strength of materials	3	2	4
Basic mechanisms	2	9	5
Electricity	3	2	4
Hydraulics and pneumatics	2	2	3
American institutions	2	0	2
	12	15	18
Fourth Term			
Machine design	3	0	3
Basic tool design	1	6	4
Design problems	1	9	5
Industrial organizations and institutions	3	0	3
Psychology and human relations	3	0	3
	11	15	18

Total 72 semester-hours

(This is a tentative curriculum developed for the Area Branch, Division of Vocational Education, U. S. Office of Education. Detailed course outlines and suggested reference materials are available from that office.)

TABLE D-7. Mechanical Technology Curriculum Outline (Production Major)

FIRST YEAR

	Class Hours	Lab. Hours	Credit Sem. Hrs.
First Term			
Orientation	1	0	0
Materials of industry	3	0	3
Mechanical drafting I	2	6	4
Manufacturing processes I	2	3	3
Mathematics I	5	0	5
Communication skills	3	0	3
	16	9	18
Second Term			
Technical reporting	2	0	2
Manufacturing processes II	2	3	3
Mechanical drafting II	2	6	4
Mathematics II	4	0	4
Mechanics and heat	4	4	5
	14	13	18

SECOND YEAR

	Class Hours	Lab. Hours	Credit Sem. Hrs.
Third Term			
Motion and time study	4	4	6
Statistics and quality control	2	2	3
Electricity	3	2	4
Hydraulics and pneumatics	2	2	3
American institutions	2	0	2
	13	10	18
Fourth Term			
Plant layout and materials handling	3	3	4
Process planning	3	3	4
Production problems	1	9	4
Industrial organizations and institutions	3	0	3
Psychology and human relations	3	0	3
	13	15	18

Total 72 semester-hours

(This is a tentative curriculum developed for the Area Branch, Division of Vocational Education, U. S. Office of Education. Detailed course outlines and suggested reference matrials are available from that office.)

TABLE D-8. Production Technology Curriculum

FIRST YEAR

First Term*	Class	Lab.	Credit
Tech. Math I	5	0	5
Tech. Drawing I	0	6	3
Metals Lab. I	0	3	1
Tech. Report Writing	3	0	3
Physics I	3	2	4
Electricity I	4	2	5
Physical Education	0	2	1
	15	15	22

Second Term	Class	Lab.	Credit
Tech. Math II	5	0	5
Tech. Drawing II	0	3	1
Metals Lab. II	0	3	1
Physics II	3	2	4
Electricity II	4	2	5
General Chemistry I	4	2	5
Physical Education	0	2	1
	16	14	22

Third Term	Class	Lab.	Credit
Tech. Math III	5	0	5
Public Speaking	3	0	3
Applied Mechanics	4	0	4
General Chemistry II	2	2	3
Tech. Drawing III	0	6	3
Metals Lab. III	0	3	1
Electrical Machinery	3	0	3
Physical Education	0	2	1
	17	13	23

SECOND YEAR

Fourth Term	Class	Lab.	Credit
Tech. Math IV	4	0	4
Strength of Materials	4	0	4
Mtls. of Engineering	3	0	3
Metals Lab. IV	0	3	1
Mfg. Processes	3	0	3
Mechanisms	3	3	4
Electronics	3	2	4
Physical Education	0	2	1
	20	10	24

Fifth Term	Class	Lab.	Credit
Economics	4	0	4
Human Relations	2	0	2
Materials Test Lab.	0	3	2
Plant Layout and Materials Handling	3	0	3
Cutting Tool Design	2	3	3
Jig & Fixture Design	2	5	5
Methods Time Measurement	4	2	5
	17	13	24

Sixth Term	Class	Lab.	Credit
Industrial Org. & Mgt.	3	0	3
Mfg. and Tool Costs	3	0	3
Production Control	3	0	3
Statistical Quality Control	5	0	5
Die Design	3	9	7
Precision Measurement and Inspection Methods	1	3	2
	18	12	23

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* Term consists of 13 weeks

TABLE D-9. Highway Technology Curriculum

FIRST YEAR

First Term	Class	Lab.	Credit
Communication Skills	3	0	3
Technical Math.	5	0	5
Sociology	3	0	3
Physical Education	0	2	½
Construction Procedures I	2	2	3
Mech. Drawing	0	6	3
Elem. Surveying	2	4	4
	15	14	21½

Third Term	Class	Lab.	Credit
Communication Skills	0	0	3
Technical Math	5	0	5
Physics (Mech.)	3	2	4
Physical Education	0	2	½
Construction Materials	1	4	3
Topographic Drawing	0	6	3
Advanced Surveying I	2	6	5
	11	20	23½

Second Term	Class	Lab.	Credit
Communication Skills	3	0	3
Technical Math.	5	0	5
Intro. Physics	3	2	4
Physical Education	0	2	½
Construction Procedures II	2	2	3
Mech. Drawing	0	6	3
Engineering Law	3	0	3
	16	12	21½

Fourth Term	Class	Lab.	Credit
Communication Skills	3	0	3
Advanced Math. (Elective)	3	0	3
Elements of Design	2	4	4
Strength of Materials	3	6	6
Advanced Survey II	1	6	4
	13	16	20

SECOND YEAR

Sixth Term	Class	Lab.	Credit
Human Relations	3	0	3
Highway Design	2	4	4
Drainage	2	4	4
Photogrammetry	1	4	3
Structural Design	2	4	4
	10	16	18

Seventh Term	Class	Lab.	Credit
Intro. Economics	3	0	3
Industrial Relations	3	0	3
Construction Planning and Eco.	3	0	3
Cost Analysis	1	6	4
Concrete Design	2	4	4
Soil Mechanics	2	2	3
	14	12	20

(NOTE: During the Fifth Term (Fall) and Eighth Term (Summer) the students will be on Cooperative Work Assignment at six credits per term.

* Each term covers a period of approximately eleven weeks.

APPENDIX E

GENERAL DEFINITION OF TECHNICIAN

TECHNICIAN—in support of engineers and scientists:

A term applied to one who performs specific tasks which are functional parts of scientific or engineering activities requiring knowledge of fundamental theory. The work activities sometimes require highly developed manipulative skills, as in the use of instruments, tools and/or special devices.

The range of work activities varies in complexity, but is usually in a specialized field of research, design, development and/or construction; in exploration, measurement, analysis and/or application of basic scientific concepts; and in control of production facilities and manpower. The performance of such work activities is based upon:

1. Knowledge of the underlying scientific, engineering and/or mathematical principles related to the specialized field of work and . . .
2. The application of established scientific techniques and methods toward the solution of practical problems encountered in the field of specialization.

Technicians usually become qualified through technical institute type training, on-the-job training, or a combination of both.

APPENDIX F

TECHNICIAN OCCUPATIONS SURVEYED

Survey Title Numbers and Definitions With Cross-Reference to the DICTIONARY OF OCCUPATIONAL TITLES and D.O.T. Codes

1 AIR-CONDITION & REFRIG. TECHNICIAN: Assists or works in support of air-conditioning and refrigeration engineer and deals with more complex and technical work than is usually required of air-conditioning or refrigeration mechanics. Engages in work associated with research, manufacture, operation, sales, and/or maintenance in accordance with engineering specification. (D.O.T. Reference—developed from AIR-CONDITIONING ENGINEER: 0-19.01)

2 BUILDING INSPECTOR: Inspects new and old buildings for compliance with municipal and State building codes and laws. (D.O.T. Reference-BUILDING INSPECTOR: 0-79.06)

3 CHEMIST, ASSISTANT: Assists or works in support of Chemical Engineers, or Chemists: Applies knowledge of laboratory techniques and fundamental chemistry. Engages in chemical research and testing work in accordance with chemists' or engineers' specifications. (D.O.T. Reference—CHEMIST, ASSISTANT: 0:50.22)

4 CIVIL & CONST. TECHNICIAN: Assists or works in support of Civil and Construction Engineers and deals with more complex and technical work than is normally required of building trade craftsmen: Applies knowledge of fundamental civil engineering theory and construction techniques. Participates in estimating costs, purchasing materials, preparing specifications, etc. (D. O. T. Reference —Developed from CIVIL ENGINEER and CONSTRUCTION ENGINEER: 0-16.01)

5 CLERICAL TECHNICIAN: Studies clerical and statistical methods in industrial and commercial establishments. Prepares reports on procedures and tasks of individual workers. Devises new or revised forms, procedures and/or methods. (D.O.T. Reference—CLERICAL TECHNICIAN—0-69.97)

6 CLOTH DESIGNER: Creates patterns of new styles of cloth; makes sketches of cloth patterns. (D.O.T. Reference—Developed from CLOTH DESIGNER: 0-46.91)

7 CLOTH TESTER: Performs physicial and chemical tests on cloth. (D.O.T. Reference—CLOTH TESTER: 0-50.32.)

8 CLOTH TESTER, QUALITY: Makes a test of tensil strength of

filling, warp and woven cloth to determine exact texture of goods. (D.O.T. Reference—CLOTH TESTER, QUALITY: 0-50.42)

9 **CLOTHES DESIGNER:** Creates, designs and prepares patterns for new types and styles of men's women's and children's wearing apparel or knitted garments. (D.O.T. Reference—CLOTHES DESIGNER: 0-46.01)

10 **COMMERCIAL ARTIST:** Designs artistic illustrations for publications and displays: May create illustrations for advertising copy, manufacturer's catalogs, newspapers, books, magazines, etc., may design fashions, showcards, posters signs or labels for containers, packages and products, etc.; may prepare maps, charts, diagrams sketches, etc. (D.O.T. Reference—Developed from a combination of definitions included under the three digit designation for COMMERCIAL ARTIST: 0-44.—3

11 **COST TECHNICIAN:** Assists or works in support of cost accountant in classifying labor, material and overhead costs to compute unit cost of product or service. (D.O.T. Reference—Developed from ACCOUNTANT, COST: 0-01.10)

12 **DIE DESIGNER:** Makes drawings of dies necessary to form complete stampings of metal parts. Decides on number of sets of dies necessary to change metal blank into finished piece. (D.O.T. Reference—DIE DESIGNER: 0-48.42)

13 **DRAFTSMAN, ELECTRICAL:** All draftsmen associated with plans and patterns for electrical wiring circuits radio, TV or electronic equipment; electric motors, appliances, transformers, instrument panels, switchboards, etc. (D.O.T. Reference—DRAFTSMAN, ELECTRICAL: 0-48.11)

14 **DRAFTSMAN, MECHANICAL:** All draftsmen associated with development of plans or patterns for machines, machine tool or mechanical equipment, and/or fabricated products. (D.O.T. Reference—DRAFTSMAN, MECHANICAL: 0-48.18)

15 **DRAFTSMAN, STRUCTURAL:** All draftsmen associated with development of plans and patterns for structural forms such as building, bridges and other commercial and industrial structures; and/or drafting of plans for installation of systems and facilities such as air-conditioning, heating, ventilating and plumbing. (D.O.T. Reference—DRAFTSMAN, STRUCTURAL: 0-48.25)

16 **DRAFTSMAN, TOPOGRAPHICAL:** All draftsmen associated with landscape surveying and/or map making. (D.O.T. Reference—DRAFTSMAN, TOPOGRAPHICAL: 0-48.26)

17 **ELECTRIC POWER TECHNICIAN:** Assists or works in support of Electrical Engineer and deals with more complex and technical work than is normally involved in equipment operating or repair work. Applies knowledge of fundamental theory of electricity either involving power generation and distribution, or electrical machinery and equipment manufacture. Participates in special research, development and/or production work in accordance with engineering specifications. (D.O.T. Reference—Developed from ELECTRICAL ENGINEER; 0-17.01)

18 **ELECTRONICS TECHNICIAN:** Assists or works in support of Electronic Engineers and deals with more complex and technical work than is normally involved in routine operating or repair work: Applies knowledge of fundamental theory of electronics. Participates in special research, development, and/or production work, in accordance with engineers' specifications. (D.O.T. Reference—Developed from ELECTRONICS ENGINEER: 0-17.01)

19 **ESTIMATOR (MANUFACTURING):** Prepares production and/or installation cost estimates for customers by computing costs of labor, material, overhead, and equipment installation of manufactured equipment and products. (D.O.T. Reference—Developed from INSTALLATION ENGINEER: A term applied to an engineer who specializes in installing equipment as a manufacturer's representative.)

20 **ESTIMATOR (NONMANUFACTURING):** Computes labor, material and equipment installation costs to prepare bids for contractors for construction, construction work or as an estimate for customers. (D.O.T. Reference—ESTIMATOR: 0-68.64)

21 **FINGERPRINT CLASSIFIER:** Analyzes and classifies fingerprints for identification purposes utilizing skills acquired through completion of specialized training. (D.O.T. Reference—FINGERPRINT CLASSIFIER: 0-66.33)

22 **FIXTURE DESIGNER:** Draws and designs furniture—fixtures and equipment in accordance with customer's wishes fitness for proposed use and money to be expended. (D.O.T. Reference—FIXTURE DESIGNER: 0-46.11)

23 **FURNITURE DESIGNER:** Designs new furniture for manufacture and lays out alterations to be made on furniture to be completed. Draws freehand and with instruments. (D.O.T. Reference—FURNITURE DESIGNER: 0-46.12)

24 **GREY-GOODS TESTER:** Tests grey-goods to determine if they are of proper quality for dyeing, printing and finishing. (D.O.T. Reference—GREY-GOODS TESTER: 0-50.33)

25 **INDUSTRIAL TECHNICIAN:** Assists or works in support of Industrial Engineers and deals with problems of efficient use of men, materials and machines in mass production process: Participates in

determining layout of machinery and equipment, planning flow of work and making statistical studies and analysis of production costs in accordance with engineers' specifications. (D.O.T. Reference—Derived from INDUSTRIAL ENGINEER: 0-18.01)

26 INSTRUCTOR OF TRAINEES: Instructs apprentices or trainees, in an industrial establishment in occupations or skills concerned with industrial processes. Plans and conducts classroom and on-the-job training programs. Uses textbooks, training manuals, manufacturing, or processing equipment, and other training materials. Exercises a qualifying combination of practical experience and academic education. (D.O.T. Reference—Developed from TEACHER, VOCATIONAL TRAINING: 0-32.30)

27 INSTRUMENT MAN: Sets up, adjusts, and operates an engineer's level, transit and other surveying instruments to establish angles and elevations for construction, map making, mining or other purposes. (D.O.T. Reference—INSTRUMENT MAN: 0-64.30)

28 LABORATORY ASSISTANT: Performs physical tests on technical materials used throughout a utility power system to assure their adherence to specifications. (D.O.T. Reference—LABORATORY ASSISTANT I:0-50.71)

29 LAB. ASSIST., METALLURGICAL: Collects and prepares statistical data for use by metallurgist. Analyzes laboratory test, reviews furnished log sheets, and issues technical advice from production laboratories. (D.O.T. Reference—LABORATORY ASSISTANT, METALLURGICAL: 0-50.27)

30 LABORATORY TESTER, COTTON: Conducts laboratory tests of yarn, cotton and cloth to determine their strength and quality. (D.O.T. Reference—LABORATORY TESTER I: 0-50.41)

31 LABORATORY TESTER, FOOD: Performs a variety of chemical tests under supervision of food chemist. (D.O.T. Reference—LABORATORY TESTER, FOOD: 0-50.46)

32 LAB. TESTER, SYNTHETIC FIBER: Prepares and photographs for analysis, microscope slides of rayon or other synthetic fiber threads. (D.O.T. Reference—LABORATORY TESTER: 0-50.93)

33 MATHEMATICS TECHNICIAN: Assists and works in support of Mathematicians: Participates in solving problems in higher mathematics incidental to investigation, developmental, and research work in scientific fields, such as engineering, physics, etc. Performs duties in accordance with mathematician's instructions and specifications. (D.O.T. Reference—Developed from MATHEMATICIAN: 0-36.76)

34 MECHANICAL TECHNICIAN: Assists or works in support of Mechanical Engineers and deals with more complex and technical work than is normally involved in machine operating or mechanical repairing: Participates in assembly and testing of industrial equipment, mechanical devices, machines, or tools. Engages in activities involving use of special instruments, tools and devices in conformance with engineers' or manufacturer' specifications. (D.O.T. Reference—Developed from MECHANICAL ENGINEER: 0-19.01)

35 PAINT TESTER: Conducts a series of tests of batches of paints, enamels, and lacquers to determine if products meet standards. (D. O. T. Reference—PAINT TESTER: 0-50.38)

36 PAPER TESTER: Tests sample sheets from each run of paper for physical properties and finish to control quality and uniformity of paper, using standard testing equipment. (D.O.T. Reference—PAPER TESTER: 0-50.50)

37 PROCESS-DESCRIPTION WRITER: Prepares descriptions of work methods and processes to be followed in an industrial establishment. (D.O.T. Reference—PROCESS-DESCRIPTION WRITER: 0-68.68)

38 PRODUCTION PLANNER: Plans production schedules for manufacture of industrial products. (D.O.T. Reference—PRODUCTION PLANNER: 0-68.50)

39 PROGRAMMER: Develops and prepares diagrams and plans for solution of mathematical, business, scientific and technical problems, by means of automatic data processing machines. (D.O.T. Reference—PROGRAMMER, CHIEF: 0-69.981)

40 PROJECT PLANNER, DATA PROC.: Participates in planning and directing installation, modification and operation of machine data-processing systems. (D.O.T. Reference—PROJECT PLANNER, DATA-PROCESSING SYSTEM: 0-68.505)

41 QUALITY CONTROL TECHNICIAN: Compiles and analyzes statistical quality control data to determine frequency and types of defects which cause rejected or substandard production (seconds). Investigates production operations to determine necessary corrective measures to apply to machine or processing operations. Participates in preparing procedures and standards for product inspection. Checks causes for excessive variation from normal amounts of waste and scrap. (D.O.T. Reference—Developed from DIRECTOR, QUALITY CONTROL: 0-18.01)

42 RADIO/TV TRANSMITTING TECH: Controls the operation of and repairs communications transmitters; adjusts equipment associated with private and network radio and television transmitting; and assumes responsibility for compliance with federal regulations. (D.O.T. Reference—Developed from RADIO OPERATOR: 0-61.30)

43 SAFETY TECHNICIAN: Inspects machinery, equipment and working conditions in establishment for hazards to workers to prevent accidents and fires. Determines if the establishment's safety rules and regulations are being observed and if accident prevention devices are being used. Reports unsafe conditions; makes recommendations; investigates accidents; and studies causes. May maintain fire prevention and first aid equipment and supplies; and may conduct safety training classes and meetings. (D.O.T. Reference—Developed from SAFETY INSPECTOR: 0-79.04)

44 SANITATION TECHNICIAN: Responsible for firm's adherence to sanitation standards set by the plant or as established by local state, and Federal laws. May supervise workers engaged in cleaning utensils, vessels, equipment, etc., used in manufacturing or processing. May direct porters in clean-up duties required to maintain physical plant and facilities in desired sanitary condition. Has knowledge of appropriate cleaning agents, detergents, insecticides, disinfectants and/or sterilization methods. (D.O.T. Reference—Developed from SANITARY-AND-SAFETY INSPECTOR: 0-95.93)

45 SCIENTIFIC HELPER: Assists Scientists in research work by performing various duties relating to type of research involved, and in accordance with scientists' instructions and specifications. (D.O.T. Reference—SCIENTIFIC HELPER: 0-50.23)

46 SHEET-METAL TECHNICIAN: Assists or works in support of Sheet-Metal Engineer and engages in work more complex and technical than is normally required of sheet-metal craftsmen. Applies knowledge of fundamental principles of sheet metal fabrications and installation in conformance with Engineers' specifications. (D.O.T. Reference—Developed from SHEET-METAL ENGINEER: 0-19.01)

47 SPEC. WRITER, ELECT. DEVICES: Lists measurements required and materials needed for constructing electrical devices in accordance with specifications of Electrical Engineer and/or electrical draftsman. (D.O.T. Reference—SPECIFICATION WRITER, ELECTRICAL DEVICES: 0-68.61)

48 SYSTEMS ANALYST: Devises computer system requirements and lay-out, and develops procedures to process data by means of automatic data-processing equipment. (D.O.T. Reference—SYSTEMS ANALYST: 0-69.985)

49 TESTER: Measures tensil strength, hardness and other physical properties of metal specimens following a prescribed series of operations on various types of testing machines. (D. O. T. Reference—TESTER: 0-50.55)

50 TIME-STUDY MAN: Observes, records and makes standard calculations of time involved in performing the less difficult industrial operations. (D.O.T. Reference—TIME-STUDY MAN: 0-68.73)

51 TOOL DESIGNER: Designs special tools and fixtures such as boring bars and milling machine tools. Frequently is required to have the abilities of a machinist, using types of tools he designs and may do drafting. (D.O.T. Reference—TOOL DESIGNER: 0-48.41)

52 WELDING TECHNICIAN: Assists or works in support of Welding Engineer and deals with more complex and technical work than is normally required of welders: Applies knowledge of fundamental physical properties of metals in determining kinds of metals to be used, effects of heat, welding process to employ, or types of welding equipment to be used. Inspects test-welded parts and studies defects or for conformance with engineers' specifications. (D.O.T. Reference—Developed from WELDING ENGINEER: 0-19.05)

53 WRITER, TECH. PUBLICATIONS: Prepares technical manuals, bulletins, and other publications. (D.O.T. Reference—WRITER, TECHNICAL PUBLICATIONS: 0-06.90)

54 X-RAY TECH., INDUSTRIAL: X-Ray photographs metal castings, weldments, metal samples, metal parts, etc., to detect imperfections. (D.O.T. Reference—X-RAY TECHNICIAN: 0-50.40)

55 YARN TESTER: Examines the yarn used in various processes to determine its standard of quality, strength, weight, twist per inch, and other physical characteristics. (D.O.T. Reference—YARN TESTER: 0-50.43)

APPENDIX G

SKILLED OCCUPATIONS SURVEYED

Survey Title Numbers and Definitions with Cross-References
To the DICTIONARY OF OCCUPATIONAL TITLES and D.O.T. Codes

56 AIR-CONDITION & REFRIG. MECHANIC: Installs, maintains, and repairs refrigeration equipment used in refrigerating plants, for conditioning air, and for cooling water in buildings. Installations are made in accordance with blueprints, specifications, sketches, and/or Technician's or Engineer's instructions. (D.O.T. Reference—REFRIGERATION MECHANIC: 5-83.941)

57 BAKER: Produces finished baked goods, such as bread, cakes, cookies, pasteries, and pies: Measures and mixes ingredients; forms dough; and bakes products in ovens regulating and timing oven temperature. (D.O.T. Reference—BAKER: 4-01.100)

58 CABINETMAKER: Performs operations, such as *cutting, shaping,* and may do *assembling,* in the manufacture of wooden furniture: Interprets work orders, drawings and blueprints; selects stock, lays out work, plans sequence of cutting and shaping. Operates such woodworking machines as band-saw, jointer, mortiser, tenoner, molder, router, etc. (D.O.T. Reference—CABINET MAKER: 4-32.100)

59 CARPENTER: Cuts, fits, and installs framing, moldings sheathing, floors, baseboards, doors, windows and frames, paneling and cabinets, and performs a variety of other duties requiring the skillful use of carpenters tools. Includes FINISH AND ROUGH carpenters, foremen and supervisors, (does not include helpers). (D.O.T. Reference —Developed from carpenters in the three digit code CARPENTERS; 5-25.—)

60 CUTTING—&—CREASING PRESSMEN: Sets up, adjusts and operates or directs operation of a platen or cylinder-type cutting and creasing press to make box blanks from cardboard and paperboard. Installs and positions cutting and scoring dies. (D.O.T. Reference—CUTTING—AND—CREASING PRESSMAN: 4-42.316)

61 DIESEL MECHANIC: Maintains and repairs Diesel engines used to power such equipment as construction machinery, trucks, buses, electric generators, pumps and ships: Diagnoses trouble, disassembles engines, and examines parts for defects and excessive wear. Reconditions and replaces parts. Includes foremen and supervisors. (D.O.T. Reference—DIESEL MECHANIC: 5-83.931)

62 ELECTRICIAN: Lays out, assembles, installs, and/or tests appliances, electrical wiring, fixtures, apparatus, control equipment, etc.; Plans proposed installations and/or repair work from blueprints and wiring diagrams. (Includes all electrical installers, assemblers, testers, and wiring workers who are required to utilize a basic knowledge of the principles of electricity.) (D.O.T. Reference—ELECTRICIAN: 4-97.010)

63 FINISHER, FURNITURE: Applies coats of stain, filler, varnish, or lacquer to wooden articles of furniture. Prepares surfaces for each successive coat and polishes and final coat to a satin or high-luster finish. (D.O.T. Reference—FINISHER: 5-16.710)

64 HEAT TREATER: Alters the physical and chemical properties of steel and/or other metal alloys to produce a specified degree of hardness, toughness, or strength by a process of controlled heating and cooling. (D.O.T. Reference—Developed from a combination of definitions included under the three digit designation for HEAT TREATERS, ANNEALERS, AND TEMPERERS: 4-87.—)

65 KNIFE GRINDER: Grinds and sharpens on power-driven grinding machines variously shaped knives and cutters used on woodworking machines. (D.O.T. Reference—KNIFE GRINDER: 5-84.130)

66 KNITTING—MACHINE FIXER: Any worker who sets up, adjusts and repairs a knitting machine, of one type or another, which is used in knitting stockings, garments and cloth: Replaces worn knitting machine parts. Work may be performed on either full-fashion, circular or seamless knitting machines. (D.O.T. Reference—KNITTING—MACHINE FIXER: 5-83.322)

67 LOOM FIXER: Inspects, maintains, and repairs looms: Puts in new harness straps and replaces worn out shuttles. Installs new warp beams and sets harness, reed, and drop-wires into position, and ties warp ends on to cloth beam. (D.O.T. Reference—LOOM FIXER: 4-16.010)

68 MACHINE-ADJUSTER-FIXER: Sets up, regulates and/or repairs cigarette making, packaging, and tobacco processing machines.

Examines machines for faulty operation and determines whether adjustments or repairs are necessary. Dismantles machines and replaces damaged or worn parts. Uses a variety of handtools in adjusting, fitting, or replacing parts, fixtures, or attachments. (D.O.T. Reference—Developed from CIGARETTE-MAKING-MACHINE ADJUSTER: 5-83.641)

69 **MACHINIST**: Constructs and repairs metal parts, tools, and/or machines using any one or combination of metal-working machines such as lathe, milling machine, planer, shaper, etc.: Understands shop mathematics and interprets blueprints and specifications; is familiar with working properties of various metals; shapes metal parts to precise dimensions within prescribed tolerances. (D.O.T. Reference—Developed from a combination of definitions included under the three digit designation for MACHINIST: 4-75.—)

70 **MOLDER-COREMAKER**: Workers engaged in one or both of the following activities: Molder—makes, molds by hand or machine for casting metal. Coremaker—makes sand cores used in molds to form hollows or holes in metal castings. (D.O.T. Reference— Developed from a combination of definitions included under the three digit designation for MOLDER: 4-81.—and COREMAKER: 4-82.010)

71 **MASTER DYER**: Plans and supervises all dying work: Compares customers' samples with color card, and sorts samples and orders received according to the type of goods, process and color required. Supervises and participates in mixing of dyes, comparing dyed samples, and making dye changes. (D.O.T. Reference—DYER, MASTER: 5-18.010)

72 **OFFSET-PRESS MAN**: Makes ready and tends an offset-printing press that imprints stock sheets with illustration or typed material from lithograph plates. Runs several sheets through press to prepare proofs; examines proofs for flaws; and cleans plate or cylinder to correct any flaws found. (All workers who operate an offset press are included in this position, even though the worker may *also* operate other types of printing presses.) (D.O.T. Reference—OFFSET-PRESS MAN: 4-48.050)

73 **PATTERN CUTTER**: Cuts complete sets of patterns, for each size garment to be made, from heavy paper using knife or scissors: Increases or decreases certain dimensions to modify patterns made by Patternmaker for garments of different sizes. (Does *not include semiskilled* cloth cutting machine operators.) (D.O.T. Reference—PATTERN CUTTER: 4.27.421)

74 **PATTERNMAKER, CLOTH**: Draws outline of garment parts on paper from which cloth pieces are cut, using sample pieces, sketches or specifications as guides: May cut pattern pieces. Marks identification of part on patterns. (D.O.T. Reference—PATTERNMAKER: 4-27.432)

75 **PATTERNMAKER, FURNITURE**: Lays out patterns of furniture parts on paper, stock, or plywood and operates various wood working machines to cut out the patterns and fashion them for use. Draws or traces from blueprints outlines of parts. Marks identification of part on patterns. (D.O.T. Reference—PATTERNMAKER: 5-17.080)

76 **PHOTOLITHOGRAPHER**: Photographs in artificial light either illustrations or typeset material to prepare a positive print for use in lithographic printing, enlarging or reducing print to desired size. (D.O.T. Reference—PHOTOLITHOGRAPHER: 4-46.200)

77 **PIPE-STEAM FITTER**: Installs, bends, cuts, and threads air, water, and gas pipes and fittings in a manufacturing establishment; and/or installs pipes and equipment that must withstand high pressure for distribution of steam. (D.O.T. Reference—Developed from a combination of definitions included under the three digit designation for PLUMBERS, GAS FITTERS, AND STEAM FITTERS: 5-30.—)

78 **PLATER**: Covers metal objects electrolytically with a coating of nickel, chromium, cadmium, or other metal to provide a corrosion-protective coating, to build up worn surfaces, or for other purposes. (D.O.T. Reference—PLATER: 4-74.010)

79 **PRINTER**: Performs any one or *combination* of duties concerned with hand and/or machine setting of type, assembling of type and cuts in chases, perforating strips of type-casting-control paper, and related duties prior to printing operations. (Includes all printers who have completed apprenticeship training, *and also all* workers *currently undergoing* training as apprentice printers.) (D.O.T. Reference—PRINTER: 4-44.010 combined with PRINTER APPRENTICE: 7-09.010)

80 **SEWING-MACHINE REPAIRMAN**: Inspects, lubricates, adjusts and repairs sewing machines in sewing departments of apparel, textile & furniture upholstering: Regulates length of stroke of needle and horizontal movement of feeding mechanism. Replaces or repairs worn parts. (D.O.T. Reference—SEWING-MACHINE REPAIRMAN: 5-83.641)

81 **SHEET-METAL WORKER**: Studies drawings and specifications of articles to be made and outlines dimensions of parts on sheet-metal: Operates sheet-metal fabricating machines and uses tools and equipment required for the trade. (D.O.T. Reference—SHEET-METAL WORKER: 4-80.010)

82 **SPINNING-FRAME FIXER**: Maintains and repairs spinning machines in good working condition: Makes repairs and replaces spindles, rollers, guides, gears, pulleys, etc. (All workers engaged in maintaining spining frames are included in this position, even though

the Spinning-Frame Fixer may also work on other similar types of machines.) (D.O.T. Reference—Developed from MACHINE FIXER: 5-83.324)

83 **TOOL-AND-DIE MAKER:** Constructs, maintains, and repairs machine shop tools, jigs, fixtures, and instruments; and/or *dies* used for forging, punching, stamping and other metal forming work. Calibrates *tools*, instruments, etc., and/or *dies* according to specifications. Is familiar with working properties of various metals. Operates various machine tools, performing lay-out work, and fitting and assembling parts in accordance with specifications or needs. (D.O.T. Reference—TOOL-AND-DIE MAKER: 4-76.040)

84 **TOOL-GRINDER OPERATOR:** Sharpens cutting tools, jigs, and fixtures with a modified universal grinder, using variously shaped abrasive wheels: Frequently required to work to tolerances as close as 0.002 inch, using optical or mechanical precision measuring devices. (D.O.T. Reference—TOOL-GRINDER OPERATOR: 5-84.110)

85 **TRUCK MECHANIC:** Repairs and overhauls trucks performing such duties as diagnosing trouble, disassembling and overhauling engines, transmissions, clutches and other assemblies. Repairs or replaces worn or broken parts. Includes foremen and supervisors. (D. O. T. Reference — TRUCK MECHANIC: 5-81.030)

86 **UPHOLSTERER:** Installs, arranges and secures springs, padding, and covering material such as cloth or leather to frames of chairs, couches and other furniture: (Duties of this job vary from one plant to another. In smaller firms the upholsterer may complete all phases of the job, while in larger establishments the upholsterer may specialize in one phase or type of furniture. (D.O.T. Reference—UPHOLSTERER II: 4-35.720)

87 **WELDER:** Welds metal parts by using one or more of the following types of welding: Acetylene (oxyacetyline torch), electric-arc, atomic (atomic-hydrogen-arc welder), and/or helium-arc (inert-gas welder). (D.O.T. Reference—Developed from a combination of definitions included under the three digit designation for WELDER: 4-85.—)

APPENDIX H

CONCENTRATION OF SELECTED INDUSTRIES IN NORTH CAROLINA

Using the North Carolina Directory of Manufacturing Firms—1960 and the 1962 supplement,* employment was estimated and tabulated for selected industry classifications by counties. Summaries of the tabulations are shown on the seven maps which follow.

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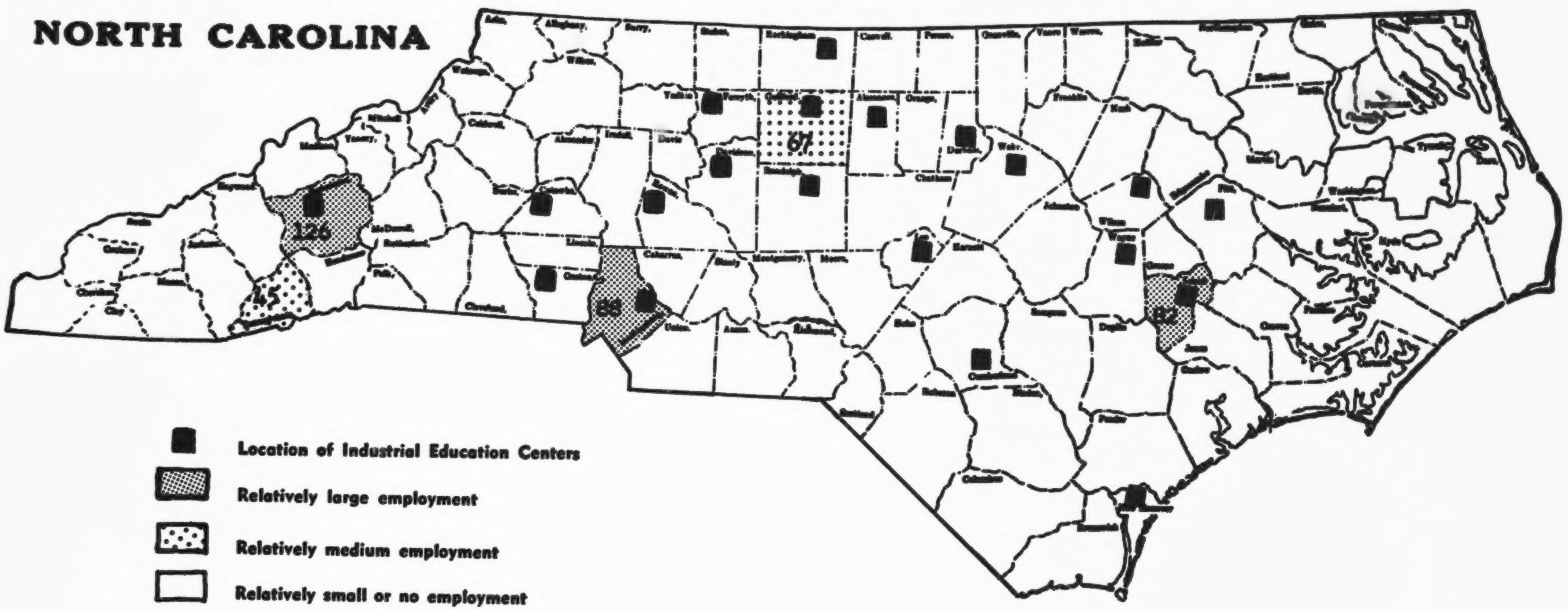
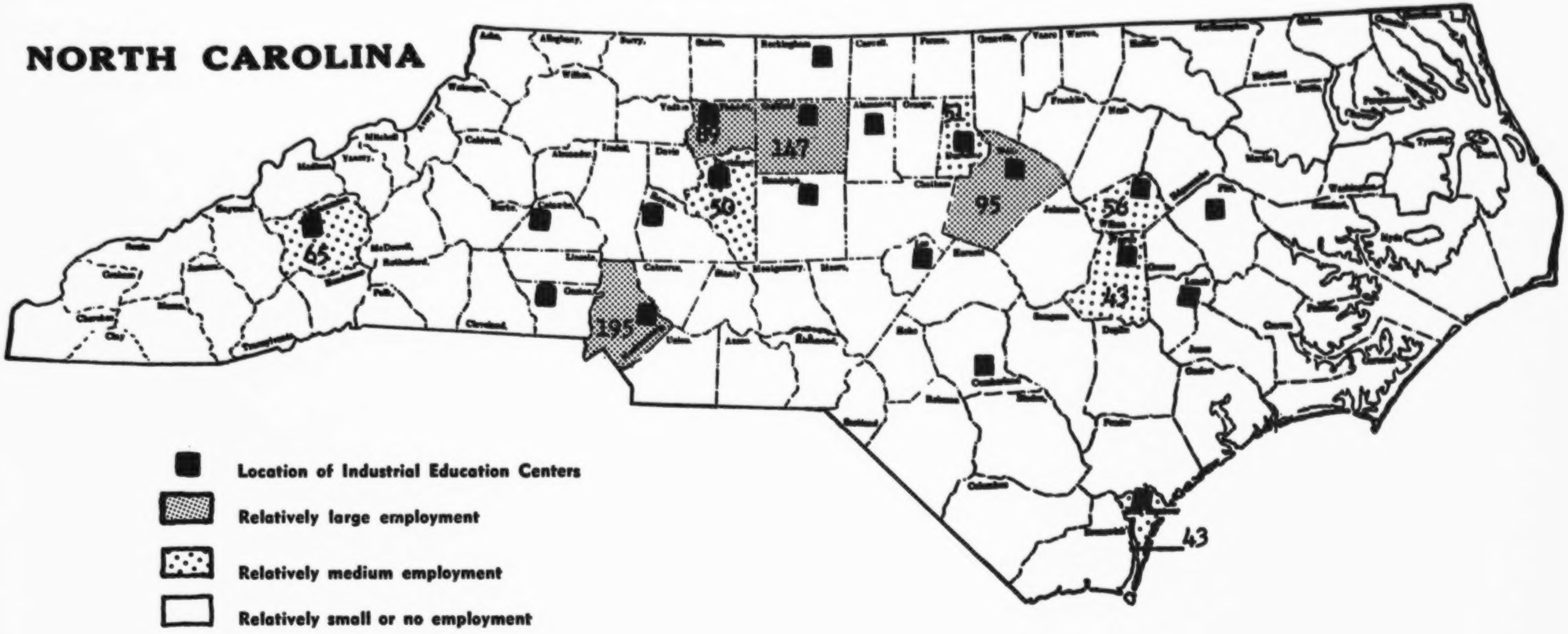
* North Carolina Department of Labor, Division of Statistics, *North Carolina Directory of Manufacturing Firms*, Raleigh, 1960, and 1962 Supplement

FIG. H-1. Relative Concentration of Employment in the CHEMICALS AND ALLIED PRODUCTS Industry, 1960


NORTH CAROLINA
126
45
67
88
82
■ Location of Industrial Education Centers
▩ Relatively large employment
⁘ Relatively medium employment
☐ Relatively small or no employment

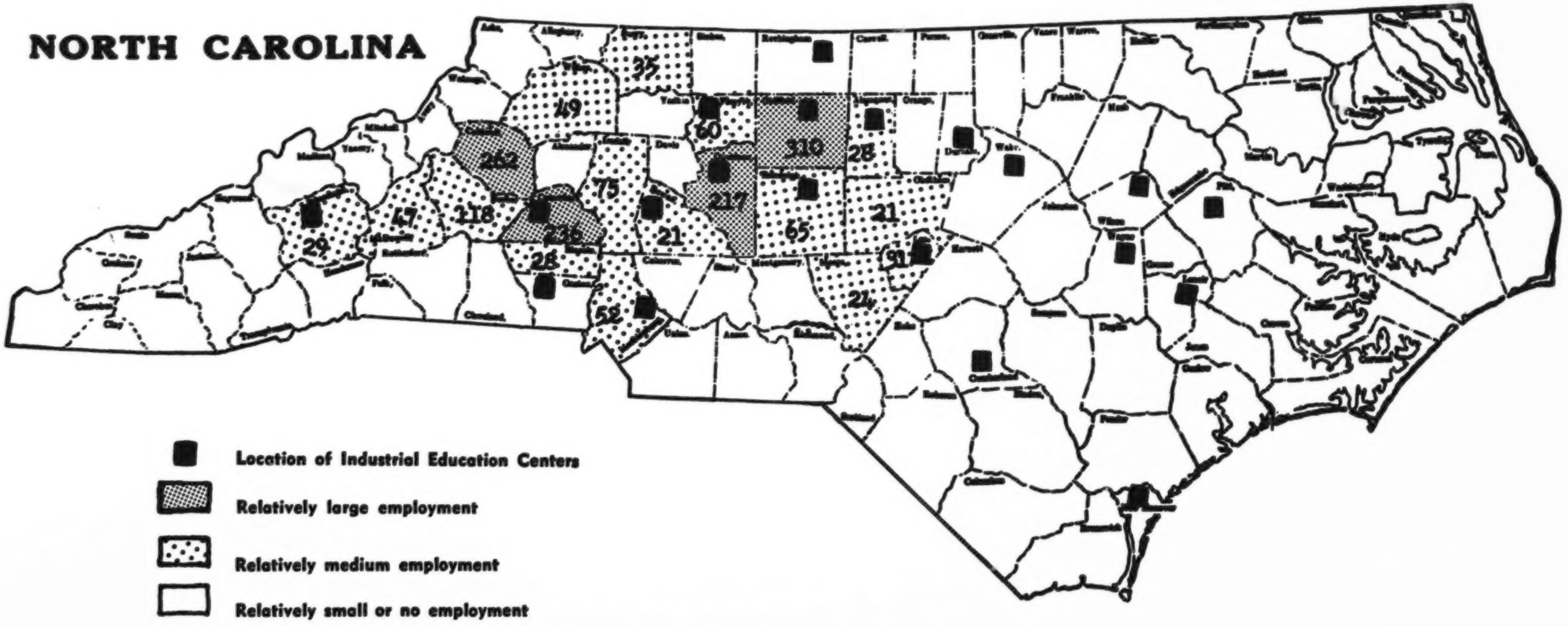
Index number—Each index number represents 25 employees. An index number of 50, for example, would indicate an employment of 1250 people.

FIG. H-2. Relative Concentration of Employment in the FOOD AND KINDRED PRODUCTS Industry, 1960


NORTH CAROLINA
65
195
147
50
51
95
56
43
43
Yadkin
Davie
Rockingham
Caswell
Person
Alamance
Orange
Chatham
Cabarrus
Stanly
Montgomery
Moore
■ Location of Industrial Education Centers
▨ Relatively large employment
⁘ Relatively medium employment
☐ Relatively small or no employment

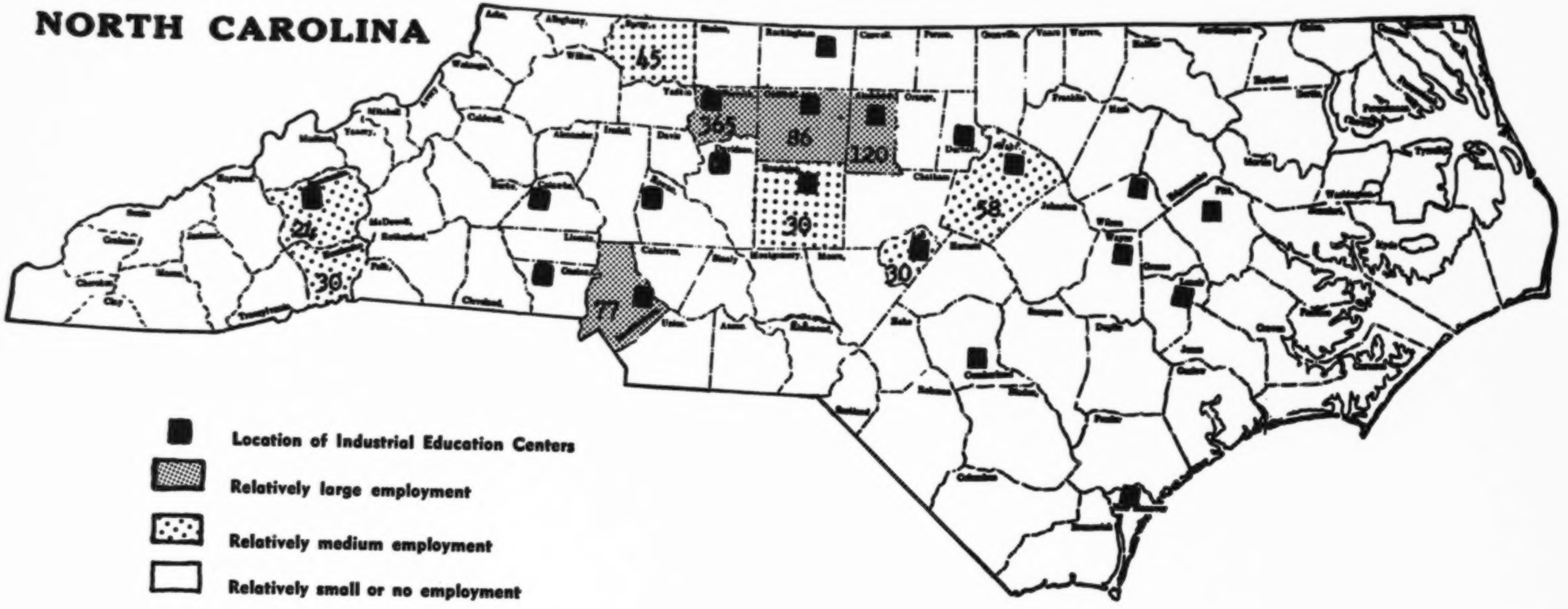
Index number—Each index number represents 25 employees. An index number of 50, for example, would indicate an employment of 1250 people.

FIG. H-3. Relative Concentration of Employment in the FURNITURE AND FIXTURES Industry, 1960


NORTH CAROLINA
35
49
60
262
310
28
75
217
118
47
236
21
65
21
29
28
91
52
24
Location of Industrial Education Centers
Relatively large employment
Relatively medium employment
Relatively small or no employment

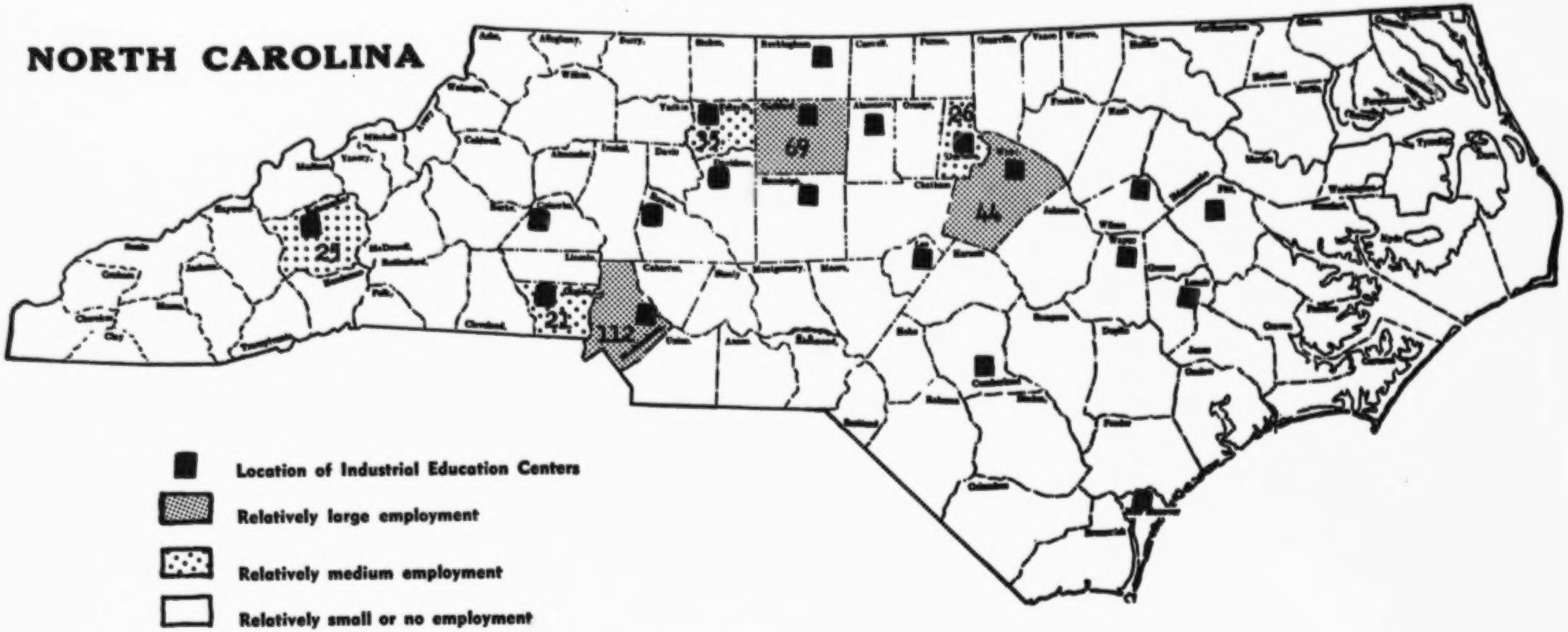
Index number—Each index number represents 25 employees. An index number of 50, for example, would indicate an employment of 1250 people.

FIG. H-4. Relative Concentration of Employment in the ELECTRICAL MACHINERY, EQUIPMENT, AND SUPPLIES Industry, 1960


NORTH CAROLINA
45
365
86
120
30
58
30
24
30
77
■ Location of Industrial Education Centers
▨ Relatively large employment
⁙ Relatively medium employment
☐ Relatively small or no employment

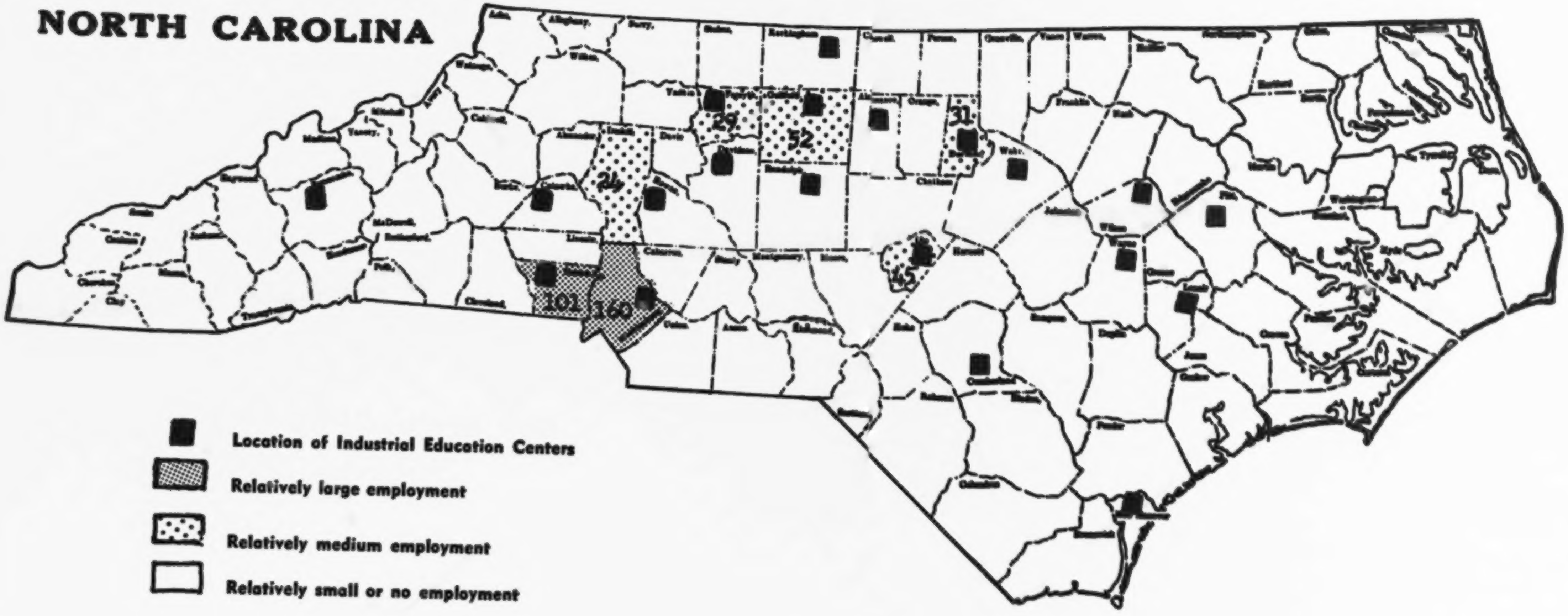
Index number—Each index number represents 25 employers. An index number of 50, for example, would indicate an employment of 1250 people.

FIG. H-5. Relative Concentration of Employment in the PRINTING, PUBLISHING, AND ALLIED Industry, 1960


NORTH CAROLINA
25
35
69
26
44
21
112
Location of Industrial Education Centers
Relatively large employment
Relatively medium employment
Relatively small or no employment

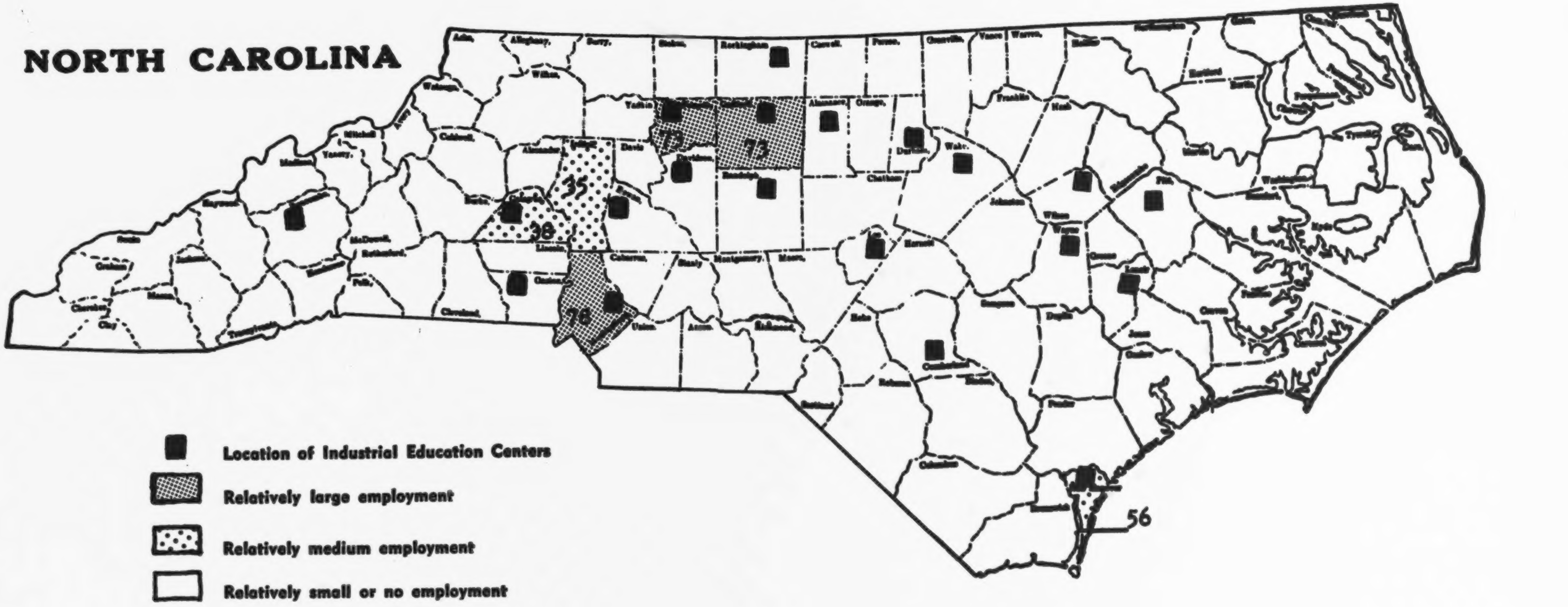
Index number—Each index number represents 25 employees. An index number of 50, for example, would indicate an employment of 1250 people.

FIG. H-6. Relative Concentration of Employment in the MACHINERY, EXCEPT ELECTRICAL Industry, 1960


NORTH CAROLINA
101
160
24
29
52
31
45
■ Location of Industrial Education Centers
▨ Relatively large employment
⁘ Relatively medium employment
☐ Relatively small or no employment

Index number—Each index number represents 25 employees. An index number of 50, for example, would indicate an employment of 1250 people.

FIG. H-7 Relative Concentration of Employment in the FABRICATED METAL PRODUCTS, EXCEPT ORDNANCE, MACHINERY, AND TRANSPORTATION EQUIPMENT Industry, 1960


NORTH CAROLINA
73
73
35
38
78
56
■ Location of Industrial Education Centers
▨ Relatively large employment
░ Relatively medium employment
☐ Relatively small or no employment

Index number—Each index number represents 25 employees. An index number of 50, for example, would indicate an employment of 1250 people.

APPENDIX I

METHODS FOR DETERMINING STUDENT POTENTIAL AND STUDENT DEMAND FOR TWO-YEAR CURRICULA OF TECHNICAL TYPE

Method of Estimating Student Potential

The President's Commission on Higher Education[1] in 1947 observed that at least 49 per cent of the population had the ability to complete the fourteenth grade level and 32 per cent had the ability to complete advanced studies. Hence, 17 per cent (the difference between the above percentages) of the population is the student potential for completing as much as, but not exceeding, two years of post-high school curricula.

It was estimated in a study[2] in Connecticut that at least one-half of the student potential for two-year curricula, 8.5 per cent of the population, is technical-curricula student potential.

Using the above findings, student potential for North Carolina was computed as follows. The number of 18 years olds' for 1966 was estimated, using the number of 12 year olds' enumerated in the 1960 Census of Population. The age for first-year students is predominately 18 years. Therefore, the estimated number of 18 year olds' (104,197) times 8.5 per cent is the student potential for the first-year enrollment (8,859). This number doubled (17,718) is the student potential for the two-year curricula of technical type.

Based on the small number of females who are currently enrolled in technical curricula and the judgment that this will not change greatly by 1966, the student potential of 17,718 was reduced to 11,513. This was computed from the estimate that 35 per cent of the total student potential (over one half of the female population) is the number of females who should not be considered at student potential. Census data are listed by counties; thus, the student potential for each county was computed.

Method of Estimating Student Demand

Emerson stated in a recent publication[3] that "Experience has shown that in areas of reasonable population density and good transportation facilities post-high school institutions of the technical institute type might expect to enroll 20 per cent of the high school graduates who are not going to college or professional schools." It was assumed that this situation would exist within about a thirty-mile radius of an Industrial Education Center.

Hamilton[4] in a study of community college areas delineated 55 areas in the State, each of which had a radius of 30 miles or less. Industrial Education Centers are about centrally located in 20 of these areas. Various types of data were shown for each area, including the anticipated number of high school graduates for 1965. An assumption in the study was that 50 per cent of the high school graduate would go on to college, either in the local area or elsewhere.

Hence, by applying the method reported by Emerson and the data compiled by Hamilton, the number of students who would desire to enroll in technical education was estimated for each of the 20 areas containing an Industrial Education Center. This is the student demand for the first-year enrollment for 1965. To determine the total two-year enrollment for technical education for 1966, a retention rate of 60 per cent of the first-year enrollment was assumed—a rate reported by Emerson.[5]

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[1] President's Commission on Higher Education, *Higher Education for Democracy*, Vol. I, U. S. Government Printing Office, Washington, D. C., 1947.

[2] Gordon M. Harrington, *A Study of Need for Technical Institutes*, State Department of Education, Bul. No. 82, Hartford, Connecticut, 1957. pp. 38 and 39.

[3] Lynn A. Emerson, *Technical Training Beyond the High School*, Vocational Education Division, State Department of Public Instruction, Raleigh, N. C., 1962, p. 33.

[4] C. Horace Hamilton, "A Study of Community College Locations and Areas in North Carolina (a summary report)," Department of Rural Sociology, North Carolina State College, Raleigh, 1962.

[5] Emerson, *op. cit.* p. 31.

"HE WHO HATH A TRADE -
HATH AN ESTATE"
FRANKLIN